ONTARIO FIELD CROPS
RESEARCH AND SERVICES COMMITTEE

1999 ANNUAL REPORT
TO

ONTARIO AGRICULTURAL SERVICES

COORDINATING COMMITTEE

JANUARY 14, 2000

ONTARIO FIELD CROPS RESEARCH AND SERVICES COMMITTEE
Report
1999

Editors: Gary Ablett, Dave Hume, Peter Johnson, Rob Templeman, Rob Roy, Brian Hall, John Madill, and Hussein Haji

Table of Contents

	Page #
Table of Contents	2
Executive Summary	3
Introduction	5
Mandate of Committee	9
Industry Sector Scan	10
Strategic Directions	28
Resource Shifts	55
Appendix	56
1. Report on Industry Funded Tobacco Research	56
2. Report on Action on Previous Recommendations	57
3. Summary of Distribution of Recommendations	58
4. Committee Memberships	59

Executive Summary

The Field Crop sector is a dynamic industry that continues to evolve and change. Cropping patterns are changing in demand to economic pressures, new technologies are being introduced and adopted rapidly and the producer (industry) is shifting more focus to consumers as their primary customers.

The Ontario Field Crops Research & Services Committee and it's six constituent subcommittees' role, set against that background of change, is to recommend strategic research and service directions to improve the efficiency of crop production in Ontario and to improve the competitiveness of, and opportunities for, Ontario agriculture in world markets. The major role that industry plays on these committees is essential in this process.

The 1999 Report continues to emphasize what FCRSC considers it's "core" research and service direction. These are in order of priority:

Research

1. Crop Breeding and Biotechnology
2. Agronomic Technologies for Improved Production Efficiency
3. Plant and Crop Physiology
4. Variety Testing

Service

1. Delivery Methods

These core areas are detailed in the section on Strategic Directions where current research/service activities are chronicled. These recommendations represent the areas of research and technology transfer that FCRSC considers essential to the strengthening of the field crop industry in Ontario. Within each core area are commodity specific priorities. Activity is documented in each area, and rate of progress, industry needs and potential for success should dictate the shifting of resources within and across these priorities. As directed by OASCC the four core strategic directions are listed in priority. Within each core direction, less emphasis should be placed on the listed order.

The growing season in 1999 in many ways mimicked that of 1998. It was essentially a hot, dry year, not quite as hot as in 1998, but perhaps drier. Rainfall easily outgunned production systems or variety choice as the primary determinant of yield. Sub-surface moisture has certainly been depleted and a winter with abundant snow/rain would be welcome. Some of the somewhat unusual effects of a hot dry season first noted in 1998 occurred again.

Harvest moisture for corn was very low again ranging between 18 – 23% thus requiring only little artificial drying. Overall yields were good, but fusarium was an unexpected problem for some areas. Acerage and yield of soybeans remain essentially the same as in 1998, and the quality of the crop was good. As with corn, harvest came early by 2 – 3 weeks. The winter wheat crop was tremendous. Very high yields, excellent winter survival and great quality earmarked this production year. Acreage of oats, barley and mixed grain continued to decline, although acreage of winter barley increased slightly. Two years of mild winters have allowed for good winter survival of winter barley, but that is more a consequence of environmental conditions than any significant genetic gains. Hay stocks in Ontario at the end of the 1999 season are generally good to excellent. Winter survival was good in almost all areas of the province with good yields and quality. Spring canola acreage was up slightly; quality was good despite some early concerns with free fatty acids. Yields were reduced somewhat as a result of the hot, dry weather. White bean acreage rebounded to 85,000 acres in 1999. Yields were excellent which has pressured prices. Expansion in Manitoba will continue to pressure the Ontario industry. Coloured bean acreage also increased with the combination of good yields pressuring prices significantly. The tobacco crop remained steady in acreage production and value.

The influence of biotechnology on crop production in Ontario was tempered in 1999 with the uncertainty of short-term acceptance by consumers in Europe spreading to North America. Although most industry leaders expect this uneasiness to diminish in the next 2 – 3 years, for the 2000 crop year, this uneasiness will moderate the adoption of this technology.

There were a number of excellent research/service accomplishments documented in 1999: Research lead to the registration of Folicur, a fungicide for use in wheat for Fusarium; registration of OAC Rex, the first common bacterial blight resistant white bean variety developed; development and use of molecular markers expanded significantly in a number of crops; a fledging white corn industry gained strength by the introduction of new white corn hybrids. The wheat sector held a significant workshop attracting the entire industry to a one-day forum to discuss the potential to fill more of the high protein wheat market with Ontario production and an extremely successful outdoor bean show attracting over 500 producers emphasizing quality bean production, was held in Thorndale.

Introduction

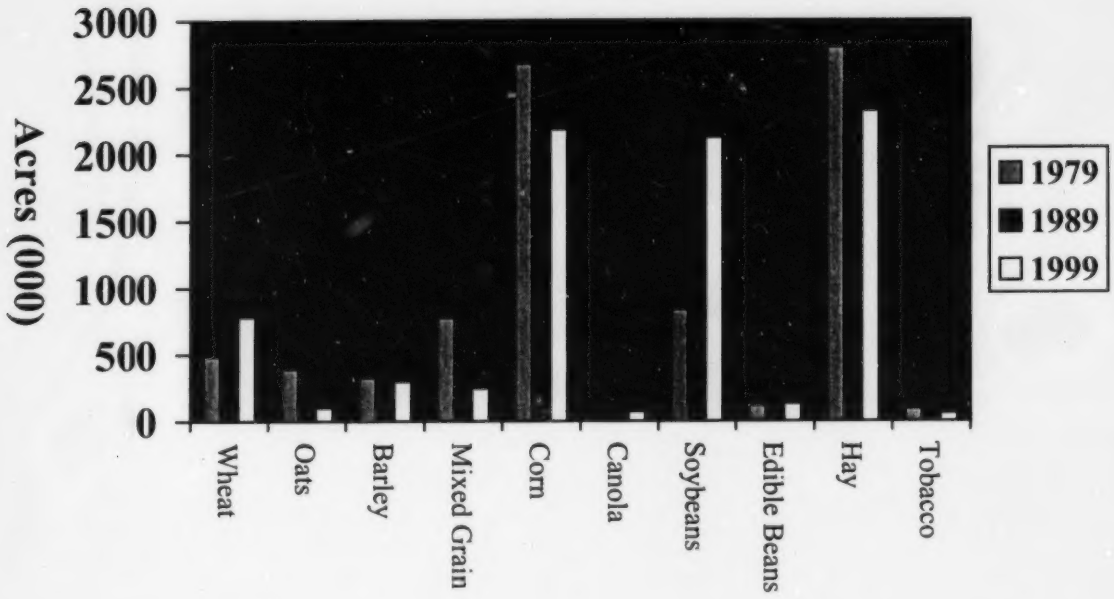
The 1999 Report of the Ontario Field Crops Research and Services Committee provides an overview of the status of field crop sector in Ontario including the identification of current issues facing the industry and the strategic directions and priorities for research and service.

As the Field Crop sector moves into the next millennium there are three prominent issues facing the industry: These are low commodity prices, safety nets and biotechnology. The Field Crop sector is currently facing unprecedented low prices across most commodities. A strong research program and an effective service program can help to mitigate the impact of these low prices, however an improvement in commodity pricing and improvement to the safety net support program will bring needed stability to the sector. Many producers had considerable difficulty in making any profit in 1999 and often " had to pay for the privilege of farming".

In addition, the slight uneasiness, previously noted with the products of biotechnology in the food chain, gained considerable momentum in 1999, to the extent that many producers are unsure of purchasing decisions as it relates to Bt Corn hybrids and Round-Up Ready soybean varieties. There is a strong desire to use the new technologies but with a concern over the ability to sell the crop and the choice of alternatives, some producers will shy away from these new products. In addition, although both products have been widely accepted as safe with no harm to the environment, consumer uneasiness driven by certain advocacy groups is causing some uncertainty. Most producer organizations support the technology as long as it is safe, does not harm the environment and provides additional opportunities and value for producers. The long-term benefit of this powerful set of technologies should not be jeopardized and the general public needs to be assured of food and environmental safety of each product.

Generally speaking in North America consumer response to foods produced through biotechnology is basically the same as for any other food. Taste, nutrition, price, safety and convenience are the major considerations (Thomas J. Hoban – North Carolina State University). Thus the goals of agricultural biotechnology in producing nutritious, safe and inexpensive food are very consistent with consumer demands. The education of consumers through a consistent message from producers, government, scientists and 3rd party groups (Medical associations) and the general trust in North America of food safety regulations and scientific rigor should ease the overall uncertainty. As a result opportunities for marketing products from modern biotechnology should expand tremendously. However, today the issue is still somewhat tenuous in North America.

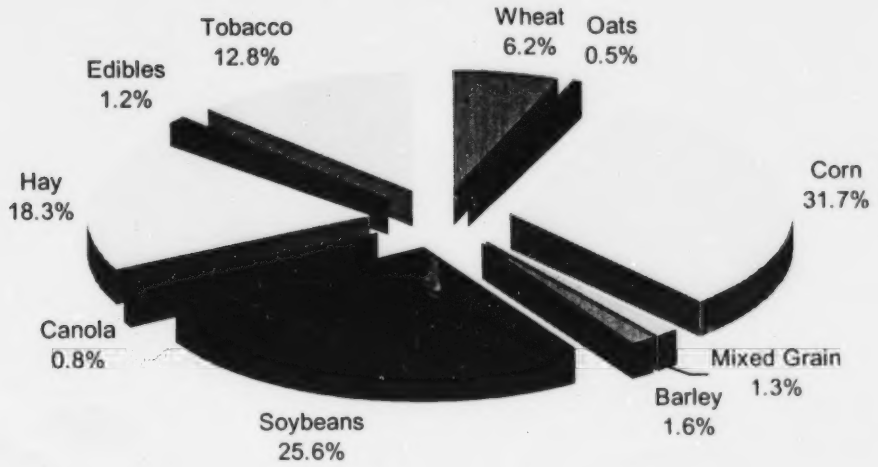
Fig. 1 Field Crop Trends 1979-1999



Source: OMAFRA statistics

The trends in the Field Crop sector over the last twenty years remain reasonably consistent. The major crops continue to be corn, soybeans, tobacco, hay and wheat (Fig. 1 & 2). Acreage and total farm gate value is decreasing for oats, mixed grain and hay (consistent with the shift to cash-crop production). Acreage and value increased significantly for soybeans, although that has stabilized over the last 3-4 years. Wheat fluctuates based on price and winter kill. The overall 1997-99 acreage and production levels are shown in Table 1. Generally yield levels were quite high, but on a farm level only if you got sufficient rainfall. For those producers who didn't get sufficient rain, drought conditions reduced yields significantly and when coupled with low commodity prices, the combination was particularly devastating.

Major Field Crops
Relative Farm Gate Value



Total Field Crop Value - $ 2.5 B
Source: OMAFRA Statistics

The total farm cash receipts in 1998 for Canada was approximately $ 29.6 billion across all sectors. Ontario's share of those cash receipts was 23.3% or 6.9 billion. The farm gate value of the Field Crop sector in Ontario is approximately $ 2.5 billion. This is in comparison to farm gate value of dairy at $ 1.30 billion, other livestock at 2.3 billion, all commercial fruit crops of approximately $ 0.2 billion, and vegetable, mushroom and greenhouse crops of $ 0.472 billion.

Ontario field crops are a source of major exports, with approximately 75% of the white bean crop, 15% of the soybean crop and 12% of the corn crop being exported annually. In order to maintain the viability of agriculture in Ontario, the efficiency of production, the quality, safety and marketability of all field crops need to continually improve. This is one of the primary goals of agricultural research.

Table 1. Estimated Area, Production and Farm Value of Specified Field Crops, Ontario, 1997, 1998 and 1999

Crop	Year	Area June 1 Units	Area For (a)	Production Harvest	Production Yield	Farm Value Per Total	Farm Value Per Unit	Farm Value Total
		acres	acres	units/acre	'000 units	$	$'000	
Winter Wheat	1997	bu	450,000	450,000	61.1	27,500	3.85	106,000
	1998	bu	710,000	710,000	62.7	44,500	3.24	144,200
	1999	bu	710,000	710,000	73.2	52,000	..	..
Spring Wheat	1997	bu	65,000	63,000	47.6	3,000	4.90	14,700
	1998	bu	90,000	90,000	41.1	3,700	3.47	12,830
	1999	bu	75,000	75,000	45.3	3,400	..	..
Oats	1997	bu	115,000	100,000	62.0	6,200	2.26	14,000
	1998	bu	110,000	100,000	61.0	6,100	1.91	11,650
	1999	bu	105,000	95,000	65.3	6,200	..	..
Barley	1997	bu	340,000	330,000	60.6	20,000	2.86	57,200
	1998	bu	325,000	310,000	56.5	17,500	2.35	41,200
	1999	bu	300,000	285,000	63.5	18,100	..	..
Mixed Grain	1997	bu	300,000	290,000	62.1	18,000	2.74	49,400
	1998	bu	290,000	280,000	60.7	17,000	1.86	31,700
	1999	bu	250,000	235,000	65.1	15,300	..	..
Grain Corn	1997	bu	1,700,000	1,690,000	112.4	190,000	3.59	683,000
	1998	bu	1,850,000	1,840,000	128.8	237,000	2.99	709,800
	1999	bu	1,825,000	1,800,000	128.3	231,000	..	..
Canola	1997	bu	65,000	65,000	36.9	2,400	8.53	20,460
	1998	bu	65,000	65,000	38.5	2,500	8.19	20,480
	1999	bu	75,000	70,000	34.3	2,400	..	..
Soybeans	1997	bu	2,320,000	2,315,000	38.0	88,000	9.16	805,700
	1998	bu	2,100,000	2,100,000	41.0	86,000	7.58	652,000
	1999	bu	2,125,000	2,125,000	40.5	86,000	..	..
Dry White Beans	1997	cwt	60,000	60,000	16.0	960	17.89	17,170
	1998	cwt	35,000	35,000	16.0	560	29.29	16,400
	1999	cwt	85,000	85,000	17.4	1,480	..	..
Coloured Beans	1997	cwt	30,000	30,000	16.7	500	..	..
	1998	cwt	40,000	40,000	17.5	700	..	..
	1999	cwt	50,000	50,000	17.0	850	..	..
Fodder Corn	1997	tons	295,000	295,000	11.7	3,450	28.00	96,600
	1998	tons	300,000	300,000	13.0	3,900	23.49	91,600
	1999	tons	300,000	300,000	15.3	4,600	..	..
Hay (b)	1997	tons	2,550,000	2,550,000	2.5	6,350	105.00	666,750
	1998	tons	2,325,000	2,265,000	2.1	4,700	98.86	464,650
	1999	tons	2,325,000	1,925,000	2.9	5,500	..	..
Tobacco, flue-cured	1997	lbs	66,000	66,000	2,347.2	154,913	2.21	341,923
	1998	lbs	65,500	65,500	2,298.9	150,576	2.17	326,418
	1999	lbs	..	..	..	..	..	..

Note: Source OMAFRA Statistics

Mandate of Field Crops Research and Services Committee:

The Ontario Field Crops Research and Services Committee and its constituent subcommittees are empowered to review and direct research and services leading to the improvement in crop production efficiencies and competitiveness of Ontario agriculture in world markets. Specifically the mandate of the committee is:

(a) To review reports submitted by Commodity-based subcommittees.

(b) To assess requirements for Field Crop Research and Services

(c) To establish priorities for Field Crop Research and Service programs

(d) To assess progress in Field Crop Research

(e) To develop and present reports and recommendations to the Ontario Agricultural Services Coordinating Committee describing the needs for Field Crop Research and Services including as appropriate information in relation to:

(i) cost-benefit
(ii) research facilities and personnel required
(iii) location best suited for the investigation
(iv) how funds might be obtained or freed to conduct new research or services
(v) operation of crop committees

(f) To consider and approve Chairs and membership of each Crop Committee

(g) To appoint representatives to other OASCC Research and Services Committees when requested.

(h) To provide an inventory of the research effort in field crops

(i) To take a lead role in the documentation of Research Accomplishments and Proposed New Research Directions for ARIO program reviews on a 4-year basis.

Industry/Sector Scan

Cereals

STATE OF THE INDUSTRY

Winter Cereals

A normal acreage (~ 725,000 acres) of winter wheat went into the winter in generally excellent conditions, with dry soils the only minor concern. Coupled with the second mild, low stress winter in a row, and an early, aggressive start to spring, the crop survived the winter very well, allowing almost all seeded acreage to go through to harvest.

Generally warm and dry conditions prevailed throughout the growing season, bordering on drought in many locations. Some early season leaf diseases did develop, but disease pressure stayed at minimal levels throughout the growing season in most fields. Physiological fleck was once again the most predominant leaf disorder.

Drizzle, mist and fog at heading of the wheat crop had many experts concerned that the 1999 wheat crop would have significant fusarium concerns. However, despite the conditions which should have allowed for initial infection, high temperatures and predominantly dry weather throughout the balance of the growing season prevented the further development of the disease, and by harvest the crop was virtually fusarium free. In fact, the crop is so low in toxin levels that many hog producers are blending wheat with toxin laden corn to alleviate related problems in the hog barn!

Yields were excellent to the north and east of London, with many producers at record yield levels. The banana belt of the southwest had average yields, a disappointment compared to the north. The full reason behind this disparity is unclear, yet must be discovered, if wheat acreage is ever to increase significantly.

The end result was a record wheat crop (1.3 million tonnes) of incredible quality. Test weights are high, falling numbers incredible (300 plus for soft white winter!), with proteins up slightly in the soft wheat crop. The only downside is a very high "W" factor, indicating slightly stronger flour that gives less cookie spread, and increases processing time on the baking line. None the less, the crop is almost full this year.

Despite this huge crop, wheat supplies are almost insufficient to meet demand, and the entire crop is sold. Domestic mills are scrambling to be sure that supplies are adequate until next year's harvest. Domestic grind is sky rocketing, with usage this year forecast at 450,000 tonnes, up 50% from just five years ago. Mills are operating at 100% capacity, and despite Ontario's rank as the third largest milling capability in North American, mills are fully booked right through the winter and are struggling to meet demand.

Soft white winter continues to dominate wheat acreage, with production of 540,000 tonnes. Soft red wheats are slowly gaining ground, due to better agronomics, with 400,000 tonnes. Fundulea production has slipped from last year's 200,000 tonnes to about 140,000 tonnes this year. In fact, the

Fundulea success story has a blemish on it, as the 1998 crop was not the quality that the industry had come to expect. While the 1999 crop is much improved, this whole scenario drives home concerns over consistency of quality and impact of the environment.

The fall of 1999 has seen a slight reduction in acreage, especially in the heavy clay soils in both the Niagara region and Essex County, areas that need wheat the most. Excessive rainfall of up to 6 inches in the Niagara region has held wheat acreage to about 60% of normal, while the closing of the ADM terminal in Windsor to wheat has caused growers in that region to reduce acreage 10-15%. Wheat acreage is near normal in the balance of the province. With early planting dates and excellent fall weather, prospects are good thus far.

Winter barley acreage continues to increase slowly, although yields were not as outstanding as in 1998. Winter rye as a forage crop is also gaining popularity.

Spring Cereals: Spring wheat acreage was somewhat reduced, at about 30,000 acres. Barley acreage dropped only slightly with oat and mixed grain acreage remaining static. Planting date was everything this year with early seeded spring cereals yielding very well, and plantings later than May 10th, a great disappointment.

A push to increase the acreage of spring wheat will continue, as new varieties of feed quality wheat have enough yield advantage to make this crop more economic. However, any increase in spring wheat acreage will likely be at the expense of the spring cereals, not other crop types.

1999 Production of Cereal Crops

Crop	Area ('000 ha)	Production ('000 tonnes)	Value[1] ('000 $)	Change in Production (%) 1 Year Ago	Change in Production (%) 5 Year Ave.
Winter Wheat					
Pastry	270	1,130	156,000	+ 10	+ 8
Non-Pastry	28	140	22,400	- 30	- 5
Spring Wheat					
Non-pastry	12	40	7,200	- 50	+ 5
Barley	130	400	50,000	- 2	- 6
Oats	45	85	11,500	0	- 2
Mixed Grain	120	327	37,600	0	0

[1] Values used/tonne: pastry wheat - $138, non-pastry winter - $160, non-pastry spring - $180, barley - $128, mixed grain - $115 and oats -$135.

Significant Research/Service Accomplishments

1. The Protein Puzzle

Accomplishment: A full to capacity audience of about 160 attended this workshop in Guelph. The focus was on the potential to fill more of the high protein market for wheat in Ontario, and the requirements to do this. This was a milestone forum, with the entire industry represented, from bakers and millers, through elevator operators and farmers, right to plant breeders, production research and extension personnel. All left with a much better understanding of the entire industry.

Why was this work undertaken? ***The Ontario wheat crop continues to over-supply soft wheat, while the 1.3 million tonne grist for bread is predominantly imported from western Canada. However, the conventional pan/loaf bread is giving way to a broader range of bread types, from European flat breads to South American pita breads. The changing needs of these bread types open new opportunities for the Ontario wheat industry, if all players can work together as a team.***

Who did the work and how was it extended? This was an effort of the OMAFRA cereal team, supported by the Ontario Wheat board, the millers and bakers association, and in conjunction with the Ontario Cereal Crops Committee. It has been extended through partnerships that have developed, and by media articles delving into some of the pertinent potentials and problems.

Number of Benefactors: Should this effort come to fruition, the entire industry and even the economy of Ontario in general, will benefit.

Dollar Impact: Estimating a $20.00/tonne price improvement on even 1/3 of the 1.3 million tonne grind yields, grower benefits of $8.67 million dollars. This potentially spins up to added value to the industry of $35 million dollars. However, the final benefit of this activity has yet to be realized.

1. Registration of Folicur

Accomplishment: Folicur was given registration in time for application on spring whets in western Canada.

Why was this work undertaken? Fusarium continues to be the number one concern in wheat production. Folicur, along with some genetic tolerance, may allow for significant reduction in fusarium infections and related toxins. This product has been available in Europe and more recently in the U.S., but was not yet registered in Canada.

Who did the work? This was a co-operative effort between Bayer (sponsors of Folicur) and the disease pathologists across Canada. Dr. Art Schaafsma of Ridgetown College, University of Guelph, spearheaded the Ontario component

Number of Benefactors: The entire industry benefits

Dollar Impact: Variable, depending on the year. Has been as high as a $60 million dollar loss.

EMERGING NEEDS

1. The expanding market for wheat in Ontario is an incredible opportunity. The shift to a wide range of non-traditional breeds by the consumer has greatly broadened the adaptability and opportunity for non-pastry wheat in the province. Mills operating at 100% capacity indicate the demand that is available for our product.

   Unfortunately, the impact of the environment, coupled with a limited variety choice, put this market at peril. The failure of the industry standard, Fundulea, to meet milling specifications in 1998, has proven how tenuous this situation currently is. It is imperative that resources be placed in this area, of sufficient quantity and backing, if the industry truly wishes to maintain and expand this potential.

2. The on-going fusarium saga seems perpetual. It has become obvious that there is a grave need for the development of a reliable measurement tool of fusarium tolerance/resistance from a pathological standpoint. Until we can accurately measure the disease reaction, it will be incredibly difficult to provide the Ontario producer with predictive measurements of varietal reactions to Fusarium.

3. It is evident that some producers are driven primarily by net returns from individual crops, rather than following agronomically sound rotations. The value of these rotations needs to be investigated, particularly for soybeans, to make producers aware of the economic and soil health advantages of maintaining proper rotations. Also, some investigation of the disparity in wheat yields between areas of relatively equal corn and soybean yields needs to be undertaken, in order to increase wheat yields to economic levels in all areas.

Corn

STATE OF THE INDUSTRY

The winter of 1998-99 was very mild with little snow cover or precipitation. Spring came early with good weather from April on. Temperatures have been above average since then, with heat units ahead all season and by the end of September total heat unit accumulation was around 10-15% higher (300-400) than long-term averages...quite phenomenal but somewhat less than 1998. Rainfall was the real story of the year with amounts extremely variable, and accounted for much of the difference in corn yields. Conditions during April and May were very dry which extended into late June before appreciable amounts of rain were received. Corn planting progressed without a hitch for the most part, with dry soil conditions allowing earlier than normal planting. In the majority of areas, corn emergence was excellent

Hot, dry conditions persisted through pollination with the fortunate receiving timely rains. Corn silage and high moisture corn harvest was two to three weeks ahead of normal, and moisture contents lower than expected. Grain corn harvest quickly followed, which was nearly completed by the end of October. Yields were generally higher than expected but in dry areas below average..

Bushel weight was excellent and moistures were lower than usual, with 18 -23% common. Corn borer pressure was spotty, but generally lower than the past few years. Common smut and fusarium ear mold was more prevalent this year.

- AAFC, Ottawa conducted a survey of pests in Ontario and Quebec field corn in August and September. Eyespot, common smut, common rust, corn borer and corn rootworms were the most common pests found at most locations. Stalk rot and ear rots were found at all locations in which the corn was mature; some locations were not mature enough to observe rot symptoms. Stewart's wilt was more widespread this year, with very severe levels found in Elgin and Kent Counties, including at the CCC trials at these locations. Overall, 1999 had less corn diseases than average due to the dry weather in July, August and September. ECORC intends to conduct an annual survey to build a database of corn pests.

- The biggest issue for the corn industry was the announcement at planting time by corn processors, first in the United States, and then in Ontario, that they will reject genetically modified corn hybrids which have not been approved for importation and usage in the European Union (EU). The U.S. Corn Refiners Associations, Inc. took the lead on this issue by releasing a statement on April 15th, 1999, which created much concern and confusion right at the critical planting period for corn. Seven genetic events, and 21 commercial hybrids owned by three corn companies were not approved by the E.U. for use. Eventually the elevators took positions, which allowed farmers to locate a market for these non-approved hybrids. For the 2000-2001 crop year, seed companies have made decisions to change some non-approved genetic events, discontinue marketing some non-approved events in order to reduce confusion for the farmer and marketplace.

- Ontario Crop Year - September 1 - August 31

YEAR*	AREA (AC.) (Million)	YIELD (Bu/ac)	PRODUCTION (Bu)(Million)	$ VALUE (Million)
1999/00"	1.82	120	218	$568
1998/99"	1.85	128.8	238	$702
1997/98	1.8	115	207	$800
1996/97	1.75	107.6	188	$838
1995/96	1.725	117.1	202	$929
1994/95	1.60	120.6	193	$619
1993/94	1.675	107.5	180.1	$602
1992/9	1.4	97	135.9	$371
1991/92	1.89	111	209	$558

" Forecast

Significant Accomplishments:

Topic: Weed Control Management Under No-Till/Conventional Systems

Accomplishments: Evaluation of several new herbicides. Transgenics in corn including Liberty Link, IR, Poast, Glyphosphate IMI-smart corn. Weed control under no-till: burndown treatments, specific weed control, label expansions. Biologically effective weed control and reduced rates under various row widths. Weed modeling.

Why was the work prompted: corn producers seek cost effective weed control.

Who did the work: Peter Sikkema, RCAT; Clarence Swanton, University of Guelph; Al Hammil and Susan Weaver, AAFC, Harrow.

Topic: Potassium Fertility Management for Corn Growing Under Conservation Tillage System

- **Accomplishments:**
  - Nutrient stratification of potassium under long-term, no-till fields does occur and is important in terms of how potassium fertility is managed in corn.
  - Potassium fertility can be effectively managed with a 2" X 2" placed starter band. Deep banding of potash or broadcasting additional potash was not nearly as effective as the 2" X 2" band. Soil test levels were important in determining the need for potash. Soil potash levels of less than 112, showed a cost-effective response to starter potash, but no response was observed for soil tests over 112.
  - These results and work elsewhere suggest the need to evaluate potassium fertility with other crops, particularly soybeans under no-till system.

Why was the worked prompted: nutrient stratification work has indicated a need to address fertilizer management strategies.

Who did the work: Tony Vyn & Associates, University of Guelph.

Emerging Issues

Site Specific Nitrogen Management: Although a nitrogen soil testing program for predicting N is available, it is not widely used, and its applicability to Ontario continues to be a topic of much debate. At the same time, environmental concerns with manure management increases the need for a reliable means of relating soil N levels to crop response and yield.

- **Tillage to Manage Compaction Concerns:** There is significant increase in use of sub soiler/zone building type of tillage tool in an effort to reduce perceived compaction concerns under row crops for both conventional and reduced tillage systems. Traditionally it was

recommended that this equipment be used at a time of year when soil conditions were dry. However, some industry and farm personnel are proposing and using this equipment in the fall

or spring when soil conditions are significantly wetter, claiming that a slot is created that will not consolidate upon drying, providing a pathway for roots. There is little Ontario research to support use of these types of equipment and questions remain.

- **Evaluating Corn Hybrids for Silage:** Increased interest in using corn silage as the basis of forage programs on beef and dairy farms and the introduction of silage specific hybrids has raised the issue of how to rank corn hybrids for silage suitability. No standard set of protocols exists for conducting corn silage hybrid trials, or for carrying out quality measures. More recent research results indicate that the traditional method of drying and grinding silage samples for in-vitro analysis may, in some cases, overestimate animal performance.

A research project is needed to:

- Verify nutritional quality measurements and methodology with actual animal performance;
- Design a protocol to evaluate corn silage hybrids in side by side trials for yield and nutritional components.

Forages

State of the Industry

Forage crops remain an essential component of Ontario's agriculture. They are grown on 65% of the farms in the province and cover 36% of the land being farmed. They continue to be the foundation of the dairy, beef, sheep, goat, horse, rabbit and game farming industries located throughout the province as they supply 60% to 85% of the nutrients fed to those animals. Forages allow Ontario farmers to produce milk and meat at a relatively low cost and in turn provide consumers with a plentiful supply of food at a price that reflects that cost. The forage industry and the industries that are dependent on them greatly contribute to the wealth of Ontario. The equine industry alone generates more than $ 4 billion annually.

Forages are grown for conserved feed on 2.52 million acres. Most forages are used on the farm where they are grown. In 1996 the value of the hay used on home farms was estimated to be $558 million. Hay sales generated another $5.5 million. Ontario hay has a reputation around the world of being a high quality product.

Hay stocks in Ontario at the end of the 1999 season are generally good to excellent. Winter survival of forages over the 1998/1999 winter was good in almost all areas of the province. The growing season of 1999 was generally good with drought hitting some parts of western Ontario. While cash prices are hard to determine, it appears that hay prices are lower than anytime in the past 4 years.

Pastures are grown on 2.5 million acres and are found on 40% of the farms in Ontario. One third of the acreage is improved pasture. The conservative estimated dollar value of the feed from pasture in 1996 was $225 million dollars. There continues to be a growing interest in using better

pasture management and grazer networks were very active. Strong prices for calves and yearlings has revitalised the beef industry, which should be reflected in more cattle and more pasture improvements in the next 2 to 3 years. In addition, numbers of sheep and lambs are up over 1998, which should again boost pasture usage.

Alfalfa based mixtures continue to be the principle choice for stored feed production. Timothy remains the main grass used with alfalfa but producers have continued to expand their use of other grass species in order to improve feed quality and acceptability, seasonal yield distribution and stand winterhardiness. A broader range of legume and grass species is used in pastures. This is due to the diversity of growing conditions, management practices, production goals, and livestock preferences. Meadow bromegrass is a valuable but little known pasture species, which has been included in OFCC testing and is now, found on the performance listing. Red clover is the primary legume used for plowdown in cash crop rotations. Red clover, timothy and birdsfoot trefoil are the major seed crops Trefoil prices remain very low to the grower, however timothy prices are stronger this year.

The diversity of forage species that are used in the province allows farming to be a viable option on all but the very poorest classes of land. Forages therefore support the economic health of all of Ontario's rural communities. Forage crops are also important to Ontario because they protect and rejuvenate soils, improve wildlife habitat and increase the beauty of the province thereby making it a more attractive place to live or visit.

Significant Research Accomplishments:

Special OFCC Forage Variety Tests

The OFCC conducts variety testing of several perennial grass and legume species. The standard testing protocol is to assess these varieties under hay management conditions. However, the OFCC can and does offer special tests when there is deemed to be sufficient interest from the seed trade and producers. Three such special tests are outlined below:

i) OFCC Alfalfa Grazing Test - In the early 1990's, breeders in the southern USA began selecting alfalfa lines that tolerated close grazing conditions. Demand was sufficient that in 1995, the OFCC offered a special alfalfa test that was to be conducted under actual grazing conditions. Protocol development was done in consultation with researchers conducting similar work in Manitoba and in the US. The test was conducted at the University of Guelph sites at Elora and New Liskeard, as well as at the Agriculture and Agri-Food Canada site at Kapuskasing. Twelve entries (including two standard check varieties) were sown in doublewide plots and replicated 5 times. Cattle grazing occurred on a rotational basis for the first two production years and the first grazing pass in the third year. Plot yields were then measured using normal plot equipment. Plot yields were adjusted to an alfalfa-only basis using hand separations. Results showed that two entries were significantly inferior to the check varieties and one entry was significantly superior to the checks. The summary of the grazing data will appear in the next issue of OFCC's Forage Crop Variety Performance brochure.

ii) OFCC Cereal Forage Test - In 1993, the OFCC was approached by a seed company interested in testing cereals and cereal-pea mixtures that were developed for forage use. This occurred at a time of increased interest in harvesting cereal companion crops as silage instead of grain. The OFCC initiated a test in 1994 to assess the yield of these entries under standard conditions. Since then, over 25 entries have been tested. Current testing locations include Kemptville, Elora, Huron Park, New Liskeard and Thunder Bay. Interestingly, performance of special purpose cereals (ie: forage oats) was only marginally better than the check variety (Rigodon oats). Thus many entries now being tested are grain type cereals that have been mixed with a field or forage-type pea. On-farm, there is more interest and greater use of cereals as forage over the past five years, in part due to the awareness raised by the OFCC testing program. The currently recommended entries will appear in the next issue of the OFCC's Forage Crop Variety Performance brochure.

iii) OFCC Annual Ryegrass Test - In 1999, the OFCC had a request to test annual ryegrass varieties. Some production work on annual ryegrass had been done previously at New Liskeard and there was a low-level but consistent interest in the crop from producers. After consulting with the Atlantic Forage Committee, an annual ryegrass testing protocol was developed to include both Westerwold and Italian types. Ten entries were received in the first year of testing (5 Westerwold and 5 Italian). Tests were sown at Elora, Huron Park, Kemptville, New Liskeard, Kapuskasing, and Thunder Bay. Huron Park did not get a stand due to dry conditions, but the other sites all had exceptional tests and took from 3 to 5 cuts. While no data will be published until two years of testing is done; first year results indicate there will be significant differences among the entries. Performance information will be available to producers in the fall/winter of 2000.

Emerging Needs

The production of consistent quality dry hay continues to be a problem in Ontario for both domestic consumption and export markets. From an equipment-engineering point of view, equipment needs to be developed to get the product harvested. Better systems need to be worked out to get around the weather problems prevalent across Ontario. The ensuing problem of marketing cash crop hay continues. Logistics and grading affect both buyer and seller. As a cash crop the dollar value in rotation is not well described in its affect on other crops in the rotation.

There are a number of issues in the dairy sector that affects the feeding of forages. The need for low potassium in grass hay for dry cows is a broad issue. Grass hay needs to be of high quality, but low in potassium through both environmental influences and through genetic selection of forage grass species. A second feeding concern is low fibre levels associated with poor growing conditions and the subsequent problems balancing the rations. There is also a need for a high yielding grass species that is compatible with alfalfa. Pasture research is primarily an issue of the beef industry, but also tends to be local and specific to the situation.

There are a couple of more distant emerging issues that should be noted. Perhaps the issue of sequestering carbon in soil via forage crops is an emerging issue, but it is so early in the process that

only a very few farmers are aware of it. The bio tech debate as an emerging issue for forages is a few years away, however, now is the time to start addressing the problems of public acceptance.

The Variety Registration Office (VRO) of the Canadian Food Inspection Agency has proposed that registration based on merit be dropped for all forage species. While consultations with stakeholders are ongoing, the OFCC decided to be pro-active and proceed as though the proposal would be adopted. The OFCC has been told by producer and seed trade representatives for several years that independent performance testing of varieties is an important role that the OFCC fulfils. The OFCC has for many years conducted registration tests and performance tests together. If the need for registration testing were to end, the OFCC could continue to offer a performance-testing program. However, if the legal requirement to enter varieties into testing (for registration based on merit) is eliminated, then there will be no means to force all new varieties to be tested in public trials. Therefore, the OFCC will have to ensure that producers have access to public performance data and that seed companies see value in entering their material in a public testing system. To examine the various strategies that the OFCC will need to use to continue the performance testing system, a subcommittee has been struck with membership from producers, the seed trade, OMAFRA, and the University of Guelph. This subcommittee will outline what strategies the committee might follow to ensure the continuation of performance testing. Then the full committee can debate the options and choose a course of action.

There has been a resurgence of interest in corn silage over the past 5 years or so. This is especially true for the dairy industry. One of the key areas of interest has been corn silage varieties with modified quality traits (high digestibility or protein). However, no organized system for comparing silage hybrids exists and there has been considerable pressures to do so. Some have proposed that corn silage is recognised as a forage crop and thus responsibility for testing and extension be turned over to the OFCC. With regards to variety testing, the OFCC supported the concept that corn silage should be evaluated as a forage crop, but also acknowledged that the Ontario Corn Committee (OCC) had the geographic locations, experienced personnel, and equipment to carry out corn silage variety testing. This was expressed by the OFCC to the chair of the OCC in writing. In the area of production and management, the OFCC production sub-committee was quite strong in stating that corn silage was a forage and research and extension efforts were needed on this aspect of the corn crop. It was felt that the OFCC could take on this role if necessary (non-variety testing issues).

Oilseeds:

State of the Industry

Soybeans:

- Ontario soybean acreage has stabilized at around 2 million acres. The introduction of new, early maturing varieties continues to move the borders of short season production areas.

- Grower enthusiasm remains high despite low prices. Competing crop prices are also at all-time lows.

Why?
- lower production costs than corn
- yields continue to improve
- expanding markets
- year to year yield stability

- The rapid expansion of soybean acres in the last decade has not come without cost. Short rotations lead to a decline in soil structure and an increase in soil borne diseases. The introduction of new disease resistant or tolerant varieties does not mask the need for better and longer rotations in significant areas of the province.

- More genetically enhanced beans hit the marketplace each year. Roundup ready (R.R.) is the thrust today but is just the tip of the iceberg. The acceptance of genetically enhanced beans is a roller-coaster ride with considerable uncertainty. U.K. is saying no, with the rest of Europe heading that way.

- There is an increasing demand for identity preserved (I.P.) and contract production in the food grade and non-G.E.O. marketplace. Norway alone continues to buy more beans than the whole Asian Market. The Western Europe export market is twice the Asian market at this time. Exports to Western Europe account for ½ of our total exports.

- The new soybean variety registration process (modified one year proposal) is currently on line for changes. This process should ensure producers quicker access to new varieties and technology.

- The need for a strong performance testing system for Ontario soybean varieties continues to be emphasized by the whole industry.

Canola:

- Close to 70 thousand acres of spring canola with an estimated harvest of 60 thousand tonnes of good quality.

- Short season soys continue to move into the southern canola growing area.

- The industry is experimenting with some fall seeded spring canola (coated seed).

- 60 % of spring canola acres were genetically enhanced this year. A.D.M. and CanAmera are selling canola oil and as such are not concerned about G.E. canola.

- Hyola 401 seed is in tight supply, as it is in demand for non-G.E. markets in other countries.

- Winter canola acreage in Ontario is presently limited to approximately 1000 acres. This segment of the industry is precariously waiting for new disease resistant, winter hardy varieties. Considerable potential if and when that happens.

SIGNIFICANT RESEARCH/SERVICES ACCOMPLISHMENTS

Biotechnology – the introduction and early implications.

Accomplishments: Herbicide tolerant varieties have been introduced across all maturity ranges for Ontario growers. Advantages at this point are consistent weed control with low impact products. The promise of "what's to come" will bring the real impact to producer, processor and ultimately the consumer. The ongoing identification of marker genes in the soybean genome continues to make science even more precise.

Who: Biotechnology is driving many of the research programs in Ontario. In agriculture the work of soybean breeders and gene jockeys is just beginning to show with the introduction of this first generation of genetically enhanced varieties.

The Soybean Growers Marketing Board and the Canadian Soybean Export Association are investigating concerns by export buyers and consensus about the safety of bio engineered foods. Working with industry they are presently developing suitable solutions to all concerned parties. A new dimension has been added to agriculture.

New Soybean Cyst Nematode (SCN) resistant varieties for Ontario growers:

Accomplishments: The introduction of new high yielding soybean SCN resistant varieties across a broader maturity range gives growers a vital tool in managing this potentially devastating soil borne disease.

Why: SCN is found in a steadily expanding area. It is now well established throughout much of southwestern Ontario.

Who: Soybean breeders, both private and public, have developed a bigger and stronger arsenal for Ontario growers. Extension efforts put the rotation package together for successful management of SCN.

Benefactors: The whole industry ultimately but none benefit more than growers hampered by the disease.

Dollar Impact: Conservative estimates place the loss to Ontario growers at $30 M/year.

Pulse Crops

STATE OF THE INDUSTRY

White Bean

The 1998 acreage of white pea beans was the lowest in over 30 years. For many of Ontario's farmers excellent soybean yields and $9.00 plus pricing for two years running proved too much of an attraction, given the added risk associated with white pea beans.

Other production areas also witnessed acreage cutbacks. Michigan growers once responsible for producing 360,000 acres of white beans, fully 50% of North American production, planted a mere 90,000 acres in 1998. Acreage in western Canada and the U.S. remained relatively stable.

The 1999 acreage of white pea beans has rebounded in all of the major producing areas. In Ontario we feel the acreage planted to white pea beans was 80-85,000 acres. The Manitoba area planted a record 100,000 acres of white beans in 1999. Excellent yields with 17 to 18 bags per acre were achieved in 1999. The down side is that with a large crop the price has softened to $24 to $25 per bag.

The smaller crop in 1998 allowed the carryover to be reduced too much more manageable levels. Along with this prices increased to where the producer of the 1998 Ontario crop received $29.28 per bag.

A new program implemented for the 1998 crop was the Partial Production Contract. (P.P.C.) The P.P.C. was put into place to enhance white pea bean marketing in Ontario in three key areas:

I. Improved cash flow at harvest.

II. Marketing flexibility for producers who desire it.

III. To pave the way for opportunities to grow white pea beans to new customer specifications, under contract.

For the 1998 crop, growers had until June 30,1998 to sign up directly with dealers. The P.P.C. beans do not go through the pool. The maximum a producer could contract was 5 bags per acre, and the Board put a cap of 100,000 bags to be sold under the P.P.C. program. A total of 64,498 bags were contacted under the P.P.C. program for 1998. For the 1999 crop 150,000 bags were allocated to the P.P.C. program. This program will continue to evolve over the next few years.

The following from and industry perspective are some of the things that research have to continue working on so this industry will continue to thrive in years to come.

1. Plant Breeding- new varieties which will improve yield, and be upright as more and more producers are going to direct cutting. It is also imperative that we maintain cooking quality and disease resistance. The field of molecular markers may expedite new variety selection.

2. Weed Control-In particular, ragweed was identified as the number one problem in white beans.

3. White Mold-An emphasis will be put on breeding resistance into new varieties and coming up with a biological control of the persistent disease. This has not been a problem in the last two very dry years.

4. Disease and Pest Control-Leafhoppers, root rot, Mexican bean beetles, tarnish plant bugs, anthracnose, and bacterial blight.

5. Other problems faced by growers-Wild life control.

Coloured Bean

Production acreage of coloured beans was approximately 8 to 10percent in 1999 to 50,000 acres. This increase in production acreage was also evident in other North American growing areas and has resulted in an over supply of coloured beans especially cranberry types. This over production has driven down prices to their current low levels of 20 to 22 cents a pound, down considerably to last year's prices of 34 to 40 cents. Yields were good to better than average this past year. A market driven revenue support payment may be triggered this depending upon what happens with the rest of the market

The industry continues to work hard with the trade to develop a registration system that will allow for maximum flexibility to adapt to a changing market. Stakeholders from research, dealers, grower groups from both eastern and western Canada have met several times and will continue to meet to come to a consensus on a system to be used to register coloured beans in Canada. The alternative to a registration system is to go the deregistration route such as in done with vegetables seeds and let the mature industry self regulate itself.

The coloured bean growers continue to support research efforts in plant breeding, disease and weed control and would like to see the research efforts in the province continue.

SIGNIFICANT RESEARCH/SERVICES ACCOMPLISHMENTS

Technology Transfer

A very successful outdoor bean show was held at the farm of Pat and Jane Elliot's farm in Thorndale on August 18. Thanks to the Elliot Family for hosting this event. The focus of the day was Harvesting Quality Beans and was attended by 500 to 600 enthusiastic bean growers and dealers. Over 3 million dollars worth of equipment was on hand for growers to see in operation. This included the latest in bean harvesting equipment with bean pullers, windrowers, air reels, direct cut headers and

state of the art combines were demonstrated. Researchers and extension staff presented a number of information sessions throughout the day to bring growers up to date information on bean harvesting for quality. The day was co-ordinated by Chris Gillard of Ridgetown College, who deserves a pat on the back for his tiring efforts. Both the White Bean and Coloured Bean grower organizations also lent their support as well as many equipment dealers and growers who brought their equipment for demonstration.

Variety development

OAC Rex (OAC95-4 common bacterial blight resistant navy) has been registered as the first bacterial blight resistant white bean cultivar. It has good yield and cooking quality and will be adaptable to the mid too later growing areas of the province. It has upright architecture and lends itself well to direct clipping.

AC Trident, a white bean cultivar has been released and has high yield potential and upright plant type for narrow row seeding and direct combine.

Four white bean lines were given interim registration support pending further cooking quality tests.

Two black bean, one cranberry, one dark red kidney, one pinto and one pink market class coloured beans were granted interim or full registration support at the winter meetings. The dark red kidney (HR85 was a semi-determinate, erect narrow canopy type bean where as traditional kidney beans are all short bush determinate type.

Harrow is maintaining seed of two alternative pulse crops, mung bean and adzuki bean.

Pathology and entomology

Molecular markers have bean developed for common bacterial blight.

EMERGING NEEDS/ISSUES

To support a stable bean industry in Ontario, diversification of market classes (i.e. black, pinto, great northern types) and search for new market/consumers in Latin America (by industry) and variety development for these.

Emphasis on quality bean production as western production increases (i.e. Pulse Canada is gearing up to do this work for the west)

Ratification of registration system, particularly coloured beans and major vs. minor market classes and testing system, etc.

Tobacco

State of the Industry

The 1999 tobacco crop amounted to about 65 million kg. It was 0.6% less than the previous 5-year average and worth more than $300 million.

The weather conditions in 1999 were favourable for seedling production during most of the spring with the exception of a cool and cloudy period followed by above average temperature during the 3rd week of May. These sudden changes in the weather severely affected freshly transplanted seedlings. Many farmers experienced a reduction in plant stand and uneven plant growth. A considerable amount of replanting was done by some farmers and at the research centre. Toward the end of the season, frost on the morning of September 22 resulted in harvest coming to an abrupt end for those growers that had not yet finished.

Field diseases were not a major concern in this year's crop, however, insect pressure was above normal for tarnished plant bugs, hornworms and aphids. Aphid populations built up earlier than normal and were often difficult to control.

SIGNIFICANT RESEARCH ACCOMPLISHMENT

Topic: Tobacco Breeding and Genetics

Two new varieties, BB68-1R (CT681) and CV166-2 (CT166) were registered this year. Results based on the two years data averaged over eight locations indicate that the newly registered cultivars are higher in yield and grade index compared to the standard checks (Delgold and Delfield). CT681 matures two days later and CT166 matures two days earlier than the checks. In addition to the superior yield and quality, CT681 offers the resistance to black root rot disease. Economic returns for CT681 and CT166 are 12% and 6% higher than the average of the check cultivars respectively. A third cultivar, CV157-3 is at the final stage of testing.

Topic: Biological control of root -lesion nematodes

Forage millet is being evaluated as a nematodes suppressor cover crop. Based on two-year data, nematode counts on both soil and roots were significantly reduced when forage millet was used in the rotation with tobacco as compared to rye.

Tobacco production and value 1991/92 – 1999/00

YEAR	AREA (HA) (x1000)	PRODUCTION (KG)(million)	VALUE($) (million)
1999/00[1]	23	65	320
1998/99	26	70	326
1997/98	26	68	342
1996/97	24	62	318
1995/96	25	66	317
1994/95	23	57	272
1993/64	29	79	311
1992/93	26	64	266
1991/92	26	69	295

1=Forecast

For the last five years the tobacco industry has been fairly stable. The Ontario flue-cured tobacco crop is grown on about 1400 farming units.

The tobacco industry recognises the need to improve tobacco quality in order to compete in a global market and continues to take a proactive role in grower education. The industry in Cupertino with, OMAFRA and OATI will, during the winter of 1999/2000, present the most recent research information on tobacco production to growers in a series of workshops, winter meetings and advanced training courses.

EMERGING NEEDS

The tobacco industry is totally dependent on soil fumigation to control plant parasitic nematodes and the disease black root rot. This year a new variety (CT681) resistant to black root rot was made available to tobacco farmers. This will reduce the use of the Chloropicrin (CP) containing

fumigants in the farming system. A biological alternative to chemical fumigation for nematode control would also be of great value to farmers.

Varieties with less propensity to produce AB@ grades are essential for the continued improvement in the marketability of Canadian tobacco. Bruising of tobacco continues to be a problem.

Blue mold, caused by *Peronospora tabacina*, can be significant source of crop loss. In 1998, crop loss amounted for up to 10 million dollars. Research is necessary to develop means of controlling this disease.

Use of marker assisted selection is needed to improve the breeding efficiency for developing black root resistant cultivars. Two RAPD markers linked to the >Burley 49' gene for black root rot (*Chalara elegans*) have already been identified. Selection for these markers can have a significant impact in terms of improving the breeding strategies and reducing the cost involved when developing black root rot resistant cultivars.

Strategic Directions: Research

The core research priorities for Field Crops have not changed from the 1998 report and are consistent with those approved by ARIO in 1998. The specific projects have shifted somewhat with areas of emphasis changing to meet industry demands. The strategic directions are listed in priority, but the relative importance of the individual commodity recommendations may not be absolute and the order listed should be interpreted solely as a rough guideline.

Recommendation 1

Issue/Direction: Field Crop Breeding and Biotechnology

Source: All sub-committees/Ontario Field Crop Research Coalition

OASCC Linkages: OPMRSC, OFPRSC

Target Agencies: ARIO, AAFC, CARC

This area of research activity reflects the primary strategic direction identified by FCRSC. It is a broad area encompassing all major field crops and a wide cross-section of goals from breeding of high-yielding well-adapted cultivars to basic science on molecular markers and transformation technologies. The objective is to develop and utilize tools of biotechnology and breeding to make significant genetic improvements manifested in effective/efficient technologies and superior germplasm/varieties/inbreds/hybrids. The priorities listed identify specific targets for genetic enhancement to improve yield potential, disease and pest resistance, winter survival, food and feed quality, new domestic and export markets. Activity is taking place within all of these areas with shifts as required. Specific details are provided as follows:

1a. BREEDING FOR YIELD & STABILITY IN SOYBEANS

Ontario Oil and Protein Seed Crop Committee: #1

Directed to: ARIO , AAFC

Background:

The objective of this priority is to highlight the importance and benefits of a continued strong emphasis on breeding for yield potential and stability in soybeans. Soybean is an extremely important cash crop in Ontario with an economic farm gate value in excess of $500 million/year. Plant breeding

results in significant increases in productivity and economic gain, without significant increases in production inputs. In Ontario, for each 1% gain in yield potential, farm gate value increases by over $5 million at current acreages (1.9 million), price ($7.50/bu) and yields (38 bu/ac).

Soybean productivity in Ontario is increasing at approximately 1.5%/year due to improved cultivars and superior production techniques. At this rate of increase, the soybean crop will be worth $615 million (in farm gate receipts) at the end of a 10-yr period. This is a farm gate payback of $375 million! Maintaining the current rate of gain will require a greater contribution from plant breeding. The amount of emphasis that can be allocated to breeding for yield depends upon the number of other traits that must be considered. Breeding for resistance to soybean cyst nematode and white mould and breeding for specific end-uses, such as food quality for export markets (tofu, natto, soymilk, miso) and in value-added fatty acid profiles in the oil is also important to Ontario soybean production. Emphasis on breeding for other targets will pressure the gains that can be achieved in increasing the yield potential. Resources must be maintained or enhanced in breeding for yield to maintain the current rate of yield gain. With a reduction of just 0.5%/year the Ontario producers would lose more than $130 million over the next 10 years and using the 5:1 multiplier ratio, the entire soybean industry $650 million less.

1b. Breeding for Natural Resistance to Corn Leaf Diseases and to European Corn Borer

Ontario Corn Committee: Priority # 1

Directed to: ARIO, AAFC

Background:

In recent years there has been a substantial increase in the use of cultural practices that leave higher levels of crop residues on the soil surface throughout the winter and subsequent growing season. The presence of corn residues on or near the soil surface increase the risk and/or severity of infestation from European Corn Borer and infection from various fungal leaf diseases, such as eyespot, leaf blights and rust. In addition, leaf diseases not currently present in Ontario, and against which hybrids grown here carry little or no resistance, are threatening to move into this province from adjacent States in the USA.

Sources of genetic resistance to leaf diseases need to be identified and rapidly incorporated into superior inbred lines, using both traditional breeding methods and biotechnology. Success of this breeding effort and the prevention of devastating disease infestations will require the support of a plant pathologist with expertise in corn diseases. Currently, such a position does not exist in Canada. The Ontario Corn Committee recommends the creation of a full-time position for a corn pathologist at ECORC.

In the breeding programs at the University of Guelph and ECORC, there has been a decrease in the effort devoted to screening material for natural resistance to European Corn Borer. This reduction has resulted from both a decrease in funding and the development of hybrids with Bt- based

protection. Because there is a risk that ECB may develop resistance to the Bt-based protection, the effort in screening for natural sources of resistance needs to be renewed to ensure continued protection for early season corn in Ontario. Funding is required for technical support at the University of Guelph and ECORC to support this work.

1 c. Cold Tolerance in Corn

OCC Priority # 2

Directed to: ARIO, AAFC

Background:

Research on cold tolerance needs to be conducted at several levels.

1. Develop reliable techniques to assess tolerance of corn hybrids/inbreds to chilling during grain filling, and determine if chilling tolerance during grain filling is correlated to early season cold tolerance.
2. Investigate genetic engineering opportunities to enhance plant defense mechanisms, modify chloroplast membrane composition, and/or modify carbohydrate levels under low temperature conditions, to improve resistance of corn to low temperatures during grain-filling.

3. Determine the conditions that limit corn growth, identify germplasm that will prosper in cool conditions and the relationship to traits that provide superior hybrid performance under the warmer conditions that exist during the summer and the cooler conditions that exist during the fall.

Ultimately, the goal is to incorporate superior cold tolerance into superior lines in corn breeding programs. The proposed research would first focus on the development of repeatable techniques to quickly screen material for cold tolerance, both spring and fall. The second phase would be to characterize the variability in different sources of germplasm and the linkages among cold tolerance, general stress tolerance and final yield. Biotechnological methods could play a significant role in a) identifying QTL traits for cold tolerance, to facilitate its incorporation into breeding material; and b) movement of cold tolerance from other species into corn for subsequent manipulation through more traditional breeding techniques.

Funding is required for support of postdoctoral fellows and graduate students. The OCPA is taking a lead position in attracting funding for research in this area.

1d. BREEDING FOR NEW OR MODIFIED OIL AND PROTEIN TRAITS FOR SPECIFIC FOOD, FEED AND INDUSTRIAL USES IN AGRONOMICALLY ACCEPTABLE VARIETIES IN SOYBEANS

OOPSCC Priority #2

Directed to: ARIO, AAFC, OFPRSC

Background:

A. Oil modifications:

1. Food Use

a)Increase palmitic and/or stearic acids (16-18%) to improve crystalline structure and use in solid fat applications
b) Reduce level of saturated fats (< 6%) to reduce negative health effects
c)Increase oleic (while lowering saturated and /or polyunsaturated fats to increase oxidate stability

2. Industrial Use

a)Increase linolenic acid (>55%) to replace linseed oil as a drying oil in the manufacture of paints and coatings
b) Add exotic fatty acids [recinoleic (>85%) and lauric acid (>50%)] to soybean to increase use in the manufacture of lubricating oil and other industrial products

B. Protein/Carbohydrate Modifications:

1. Food Use

a)Reduce content of fermentable carbohydrates to reduce intestinal discomfort and flatulence
b) Increase content of fermentable carbohydrates (sucrose, glucose, fructose) and increase the use of soybeans in the manufacture of soyfoods (miso, natto, tempeh)
c)Reduce lipoxygenase enzymes to reduce the beany or off-flavour
d) Reduce phenolics and flavonoids to reduce astringency and bitterness
e)Increase the level of isoflavones.

2. Feed Use

a) Increase the content of soybean protein to increase value of soybean meal as a high protein feed supplement.
b) Increase content of essential amino acids (methionine and cysteine)
c)Increase lysine content to reduce the concentration of crude protein in the diets of poultry and swine
d) Reduce protease inhibitor activity by 80% to improve the digestion of proteins and reduce pancreatic hypertrophy
e)Reduce phytate to improve the availabilty of minerals protein solubility

f) Reduce goitrogens to reduce the risk of goiter

Background: Soybean oil and protein are used in the manufacture of human food, animal feed, and various industrial products. Soybean oil dominates the domestic and world vegetable oil markets. The oil contains saturated [palmitic (11%), stearic (4%)], monounsaturated [oleic (25%)], and ploYunsaturated [linoleic (50%), linolenic (9%)] fatty acids. Because of its fatty acid profile, the oil is used primarily as a salad and cooking oil and as a fat in the production of shortening and margarine. Only 2% of all soybean oil produced is used in industry. Specific genetic modifications can be made to improve oil content, quality and stability. These modifications can educe processing costs and increase the marketability and value ($.08 to $3 US /bushel) of soybeans (Iowa Agriculture & Home Economics Experiment Station Special Report 92) Soybean protein constitutes about 46% of soybean meal and is used as an ingredient in animal feed, human food, and industrial products. About 95% of soybean meal is used to supply protein in livestock (poultry, swine, cattle) feeds. For use in food and products and industrial products, soybean meal is processed into various edible protein ingredients, including flour, concentrates, isolates. Most edible protein products are used to replace the use of animal and dairy proteins in foods for human consumption. Industry uses soybean protein primarily in the manufacture of paper coatings. Improving the content and quality of soybean protein can add $.06 to $.46 (US) to each bushel of soybean (Iowa Agriculture & Home Economics Experiment Station Special Report 92) and increase the nutrition, energy density, and marketability of soybean meal.

Soybean produced in Ontario must compete in the international marketplace with soybean and other oilseeds produced throughout the world. To maintain a share of the specialty oilseed market, each Ontario soybean variety must possess traits that provide added-value and a unique identity. Using current technologies (chemical mutagenesis, biotechnology, and breeding) oil and protein modifications can be made to add value and improve the marketability of soybean varieties developed in Ontario.

1e. OPPORTUNITIES FOR BIOTECHNOLOGY IN ONTARIO SOYBEAN IMPROVEMENT

OOPSCC Priority #3

Directed to: ARIO, AAFC, CARC

Backgound: Biotechnology offers opportunities for soybean crop improvement in the following areas:

A. Plant transformation- the introduction of novel genes into the soybean genome
B. Technologies to enhance conventional breeding
    a)m olecular marker-assisted selection
    b) haploidy
    c)m utagenesis

A. Soybean transformation

The introduction of genes that are not accessible by sexual means can be achieved by means of transformation. In addition, the expression of plant genes can be modulated temporally, spatially, and quantitatively. Although there has been progress in plant transformation technologies which are amenable to tissue culture and regeneration, progress in soybean transformation remains slow (although significant progress has been made recently) because of difficulties in culture manipulation. If the efficiency of these procedures can be improved, soybean transformation may become a routine and useful technique for variety improvement programs to introduce novel genes. The following traits could add value to soybean:

1. Herbicide resistance - transformation of soybean with PAT or BAR genes for resistance to Liberty Ignite (Basta). Glufosimate ammonia, along with the routine use of Round-Up Ready Technology.

2. Metabolic modifications - genes modifying the expression of ADP - glucose pyrophosphorylase, sucrose phosphate synthase or inorganic pyrophosphorylase can affect soluble sugar and starch levels.

    - cold and drought tolerance can result from increased sucrose levels in leaves
    - increased sucrose content would add value to tofu and natto type varieties

3. There are also other possibilities for genetic engineering of disease and pest tolerance and for soybean for molecular farming.

Background:

B. Technologies to enhance conventional breeding.

1. *Molecular marker-assisted selection*: The goal of plant breeding is to simultaneously combine many favourable genes as effectively and efficiently as possible. Sometimes favourable genes control the expression of traits for which selection is difficult or expensive. Occasionally a genetic linkage exists between the desired gene and an easily selectable genetic marker (e.g. morphological colour, isozyme, etc.). The selectable marker is then used to indirectly select for the gene if interest. Various molecular marker systems (RFLP, RAPD, AFLP) microsatellites, etc.) have been developed which can detect polymorphism(s) or "DNA alleles" at specific DNA loci. The relative abundance of such polymorphic loci and the ability to perform multiple diagnostic tests on a single leaf sample makes molecular markers very useful to breeders. Three major areas requiring research are:

    a) the identification of molecular markers for traits of interest in relevant germplasm
    b) the development of cost effective techniques for handling large numbers of samples
    c) the design of efficient marker assisted breeding protocols.

2. *Haploidy:* Homozygous plants obtained through doubling of anther- or microspore-derive embryos are being used in some crop improvement programs. Through this procedure, desirable genetic recombinants can be identified and the development of new varieties can proceed more

rapidly. A second useful application of microspore embryogenesis is in the development of homozygous mutants. A third application is the opportunity of a concurrent study of invitro maturation as controls for embryogenesis studies. Transformation of microspores followed by selection during maturation and subsequent pollination is another approach for making transgenic plants.

3. *Mutagenesis:* Most genes currently available for crop improvement have been patented and their use will require royalty payments. Developing our own genes through mutagenesis is an excellent way to circumvent this problem. Mutagenesis via microspore embryogenesis would be most useful approach. Furthermore, marker-assisted mutagenesis would allow the identification and isolation of the mutagenised genes, which could then be transformed into breeding lines.

1f. Fusarium Head Blight Breeding and Research on Wheat, Barley and Other Crops

OCCC Priority # 1

Directed to: ARIO, AAFC

Background: The 1996 wheat crop was devastated by Fusarium to an extent never before experienced in Ontario. Fusarium outbreaks have also been significant across the Western provinces in recent years. The food safety, quality and financial ramifications of these outbreaks are such that the whole industry could be destroyed. It is imperative than an integrated approach to controlling this disease is developed.

Fusarium head blight is a fungal pathogen that is not host specific. For instance, cereal crops may be inoculated by spores originating from corn stubble. Along with significant yield losses, the fungus produces vomitoxins, which affect animal performance, and makes the grain unsuitable for human consumption. Fusarium is of most concern in wheat crops that are destined for milling into flour.

Breeding for resistance is underway and should continue with emphasis, but the best possible scenario puts varieties 3 years away from seed supply to commercial production. This time will be extended if initial attempts to incorporate resistance results in varieties with other agronomic shortfalls. Research is needed on the pathology of the disease, to seek opportunities for cultural control and methods to improve the resistance of affected cereal species as well as to assess the potential impact of other management opportunities (rotations, tillage, pesticides, etc.).

There is also a great need to develop a repeatable test for resistance. The existing test for fusarium is not very robust and results vary greatly with test locations, despite state of the art inoculation techniques. Some varieties show the best reaction in one location and nearly the worst in another. Also, FHB indices, typically used in information provided to growers, has limited correlation to DON levels, the true concern with a fusarium infected crop. Methods of analyzing both for research and industry are imperative, with some level of confidence in the repeatability of the test.

Economic Importance: The impact of Fusarium on the 1996 wheat crop reduced farm income in excess of $120 million dollars. It cost the milling industry a further $30 million dollars to source and transport the wheat needed to replace the Ontario crop. There is some economic loss from fusarium in Ontario every year.

Social Benefits: Control of this disease will ensure a safe supply of food products for all consumers in Ontario

1g. BREEDING FOR RESISTANCE AND MANAGEMENT OF NEMATODES AND DISEASE IN SOYBEAN

OOPSCC Priority #6

Directed to: ARIO, AAFC

Background: Oilseed crops in Ontario are subject to relatively few diseases; however, 4 or 5 require control to ensure sustainable consistent production. Chemical controls are environmentally and economically undesirable. The most effective way to control diseases of oilseeds and other field crops is through genetic resistance and effective management practices. The most important diseases of soybean in Ontario and estimated crop loss as a percentage of total production in 1994 are as follows: soybean cyst nematode (SCN) (0.80), Phytophthora root rot (PR) (0.50), Sclerotinia stem decay (SSD) (0.50), Rhizoctonia/Fusarium root rot (0.40) and pod and stem blight (PL) (0.20). These diseases accounted for approximately 65,250 tonnes in lost production or approximately $20 million. Although this loss is small compared to total production (2.9%), diseases can be devastating in certain areas and to individual growers.

Control of SCN will require resistance/tolerance and effective management practices. Resistance to SCN is complex and difficult to identify but considerable success has been achieved in the USA where SCN has been a major problem for 30 years. Long-term crop rotation with nonhosts and resistant or tolerant varieties provides the most cost-effective control. As SCN spreads to additional counties in Ontario and races change, a continuous effort in breeding for resistance will be required to ensure high productivity.

Considerable success has been achieved in controlling PR by developing disease resistant cultivars. Resistance genes can be identified and incorporated into soybean varieties by relatively simple screening techniques. However, the development of new races necessitates the continuous development of new varieties with tolerance and monogenic resistance.

Sclerotinia stem rot is increasing in importance in Ontario and the north-central U.S.A. Varieties differ in tolerance to the disease but monogenic resistance has never been identified. This disease can cause severe losses but tends to occur sporadically. Crop rotation with nonhosts is recommended but once a field becomes infested with sclerotia (long term resting structures) the disease could reappear whenever conditions are favourable. Planting early varieties is effective in reducing disease severity and decreasing inoculum but growers are unlikely to accept an annual yield

loss to control a sporadic disease. Full season, resistant/tolerant varieties and an effective management package could reduce the white mould problem.

Rhizoctonia/Fusarium root rot occurs in all soybean areas and soil types. Disease severity increases with plant stress caused by alternating wet and dry soil conditions. Most commercial varieties have at least moderate tolerance that was selected along with vigour and high yield.

1h. Breeding and Identifying Wheats (all types) for Yield, Quality & Disease Resistance.

OCCC Priority # 2

Directed to: ARIO, AAFC

Background: Genetic improvement of cereal crops has been of tremendous benefit to Ontario agriculture. Data from the Ontario wheat Producers' marketing board indicates a 58% yield increase over the 25 year time period from 1969 (1.085 t/ac.) to 1994 (1.715 t/ac.) from both genetic and management improvements. The obvious benefit from this work should continue.

New developments offer further potential to go beyond only yield improvements. The development and identification of varieties with more uniformity in kernel size, and non-pastry varieties with a greater proportion of high molecular weight proteins, could greatly improve the value of the crop to millers and bakers. This work should be intensified.

Pathologists also need to be involved in this endeavour, as disease parameters continue to have major impact on quality of the crop. An excellent example of this is the dwarf bunt situation of 1997. There is a tremendous shortfall of pathologists in our system.

Economic Importance: Each 1% increase in yield returns an additional 12,000 tonnes of wheat, or $2 million dollars in added revenue to the producer. Introduction of quality parameters could further enhance economic returns, estimated at 7 million dollars annually or more.

Competitiveness: Development of higher quality wheats could greatly enhance the competitive abilities of our millers and bakers with their counterparts in the U.S.

1i. Development of Inbreds and Hybrids for Ontario

OCCC Priority # 4

Directed to: ARIO, AAFC

Background: Many of the priorities for the corn industry depend upon successful incorporation of genetic traits, natural or modified, into superior breeding lines (e.g. pest resistance, food quality, feed quality, cold tolerance, stress tolerance, nitrogen efficiency, etc.). Thus, the corn breeding programs at the University of Guelph and ECORC are the vehicles by which material for study is identified and by which desirable traits are ultimately incorporated into hybrids used by the farmers of Ontario. Although there are large hybrid development programs in the private sector, hybrid development also must continue to be part of the public breeding programs, since it is only through locally adapted germplasm that the true value of genetic enhancements to corn growers can be properly evaluated. These public programs are important sources of such germplasm to be fed into the private sector corn development programs. Additionally, breeding and evaluation techniques need to be tested on an on-going basis to ensure that the most efficient techniques are being utilized. These public corn breeding programs are also valuable training centres for new plant breeding students.

Funding is required to provide increased technical support at both the University of Guelph and ECORC.

1j MANAGING CLIMATE-RELATED RISK IN PERENNIAL FORAGE CROPS:

I) Genetic/Biotechnology Improvements with respect to winter survival.

II) Develop management techniques for improved winter survival of conventional and genetically altered alfalfa, and develop management techniques to enhance production of grasses during drought conditions.

OFCC Priority # 1

Directed to: ARIO and AAFC

Background: Perennial forages occupy more farmland than any other crop in Ontario. They provide the feed base for virtually all dairy, beef, sheep, goat, horse and ungulate farms. Although winterkill was of minor significance in most parts of Ontario last winter, producers are still concerned and fear another bad winter will result in a shortage of hay and higher prices. Since a secure supply of forage is critical to the operation of these industries, the OFCC feels that researchers have to concentrate more effort on methods to ensure that forage supply will be adequate.

Forage and livestock producers have stated quite clearly that climate related issues, especially winter-kill of alfalfa, are their number one concern. Genetic progress in alfalfa over the past 20 years has focussed on disease resistance, increased yields, and improved quality. However, specific efforts are required, by conventional or biotechnology means, to improve winterhardiness of alfalfa without deterring from other traits, especially yield, that have been improved in the past. To complement this work, improvements in the winterhardiness of orchardgrass should be made, since this grass is increasing in use with alfalfa and is the key grass species used in sown pastures in much of the province.

In addition to genetic improvements, producers want management techniques that improve the continuity of forage supply over the growing season. This would include techniques in pasture management to even forage supply during spring and summer, cope with dry weather and extend the grazing season in the fall. For stored forages, efforts should be concentrated on ensuring that management techniques are properly matched with the needs of new genetic material introduced into the marketplace. When new traits are introduced to alfalfa or other species, the management package may need to be re-evaluated. In other cases, what is considered normal management may need to change to better ensure winter-survival of currently-used varieties.

The OFCC recommends that research be directed at ensuring the security and continuity of forage supply with respect to climate-related risk through improved genetics and management practices.

1k. IMPROVING FEEDING VALUE OF FORAGES FOR STORED FEED AND PASTURE:

I) Genetic/biotechnology improvements to energy content and/or other desirable quality traits.

II) Management of forage crops to optimize feeding potential.

OFCC Priority #2

Directed to: ARIO

Background: High quality forage is the engine that drives the dairy industry in Ontario. Similarly, the beef and sheep industries rely to a great extent on high quality pasture and hay to ensure both milk production and proper rebreeding. Efforts to increase quality in both stored feed and pasture must be made to ensure that increased animal performance can be achieved from forages.

Alfalfa is the main stored forage used in Ontario. It supplies adequate amounts of crude protein when harvested at the correct stage of maturity, but is significantly lower in energy than grains such as corn or barley. Alfalfa that has been selected or genetically-modified to have higher digestible energy content would allow it to fill a higher proportion of the ration for milking cows and thus reduce feed costs. Progress has been made in the production and assessment of alfalfa varieties with reduced NDF levels and increase cell wall digestibility. Another area of interest would be to modify the types of protein found in common forage plants.

High quality forage harvested as pasture can be a very economical method to background beef cattle, develop beef and dairy breeding heifers, and grow market lambs. If these enterprises are to grow and prosper, more emphasis needs to be placed on managing the pasture resource to produce higher quality forage. Researchers need to focus on the forage quality requirements of the whole farm to integrate various methods and times of forage harvest into one complete system. Annual forage crops for stored feed or grazing should be considered here as well. The goal of the complete forage system should be to provide the maximum amount of nutrition from forages on a year round basis, supplementing with other feed sources only when the forage resource cannot provide those nutrients.

New species of forages need to be investigated for their ability to provide high quality forage in either pasture or stored feed systems. Before new types of alfalfa or other species are introduced to the marketplace, work should be done to ensure they can provide similar quality to existing material or else determine what management regime is needed to achieve the desired quality.

The OFCC recommends that research be directed at improving forage quality through genetic improvements, changes in management practices, or evaluation of new species.

1l. Quality of Food Grade Corn

OCC Priority # 5

Directed to: ARIO, AAFC

Background: Food grade quality corn represents a major value-added market for Ontario corn that has the potential to expand significantly. Currently, much of the market is being filled with corn or corn products from the U.S.A. Development of food grade quality corn suitable for production in Ontario represents a significant import-replacement opportunity, as well as an important export market (N.E. U.S. and throughout North America over the long term).

Research has begun within the University of Guelph, primarily at Ridgetown College, directed toward breeding early white, food grade corn inbreds and hybrids, suitable for production in Ontario and toward identifying yellow corn hybrids of food grade quality, in cooperation with the private sector.

Long-term funding is required to enhance the technical support for these programs and to ensure the continuation of this work.

1m. Resistance to Fusarium Ear Rot

OCC Priority # 6

Directed to: ARIO, AAFC

Background: Corn grown in Ontario continues to be prone, periodically, to severe infection by Fusarium ear rots. The toxins produced by these moulds seriously affect the performance and health of hogs, in particular, and may also affect the performance and/or health of other livestock, and humans. Livestock feeds still represent the greatest usage of corn in Ontario and the usage of corn for human consumption is increasing. Thus, high priority must continue to be given to the development of corn lines with resistance to Fusarium ear rots.

Initial work at ECORC and Ridgetown College, University of Guelph, have investigated the mechanisms of ear rot infection and identified sources of resistance. Continuing funding is needed,

however, to assist with the incorporation of genes for resistance into breeding lines and then into commercial breeding material, using both conventional breeding methods and biotechnology.

1n. Cultivar Development and Genetic Improvement of White and Coloured Beans

Ontario Pulse Crops Committee Priority # 1

Directed to: ARIO, AAFC

Background: The objectives are cultivar release and germplasm improvement through intra- and inter-specific hybridization followed by conventional and biotechnology-aided selection methods.

1) Cultivar release with:
- Improved yield potential with early to full season maturity and upright plant architype,
- Cooking and canning quality acceptable for domestic and international trade,
- Increased resistance to common and halo bacterial blight, white mold and root rot diseases,
- Pyramiding resistance to anthracnose and bean common mosaic virus races prevalent in Ontario and other major genes controlling resistance to pests,
- Transfer of resistance to potato leafhopper to dry beans adapted to Ontario.
- Testing lines/cultivars in coop. trials to identify superior lines for registration and to generate performance data.

2) Application of biotechnology to improve efficiency in cultivar development through:
- Identification of RAPD markers linked to common bacterial blight resistance genes aiding molecular marker assisted selection,
- Integrating selection methods based on molecular estimates of genetic distance with conventional selection techniques to accelerate simultaneous improvement of yield, adaptation, quality and pest resistance,
- Transfer of new genes (i.e. herbicide resistance) through transformation technique.

3) Germplasm improvement and utilization through:
- Multi-cycle intermatings of adapted and donor germplasm sources (within and between Meso-American and Andean races, and utilization of tepary bean and scarlet runner beans) to widen the germplasm base,
- Release of improved germplasm to breeders of private and public institutions.

1o. Cultivar Development and Genetic Improvement in Barley and Oats

OCCC Priority # 4

Directed to: ARIO, AAFC

Background: There are public breeding programs in barley at both Guelph and Ottawa. The public breeding of oats was rationalized in 1996 such that oat breeding would be done at ECORC (AAFC, Ottawa), with a testing program in central Ontario. The arrangement is that Quaker Oats provided funding which is matched by MII (AAFC's Matching Investment Initiative). The funds support a technical position located at Guelph, as well as part of the AAFC breeding program. An increased interest in hullless barley for the hog industry, and as an energy source for Northern Ontario, also needs to be assessed and evaluated.

Economic Importance: There were approximately 135,000 tonnes of barley produced in 1995, worth about $46 million, plus another 327,000 tonnes of mixed grain, worth $36 million. Production of sole crop oats was 85,000 tonnes, worth $11 million. In both crops, resistance to several diseases and races are being pyramided into new varieties so that resistances last longer after the new varieties are released. These crops are of special importance in the shorter growing season areas of Ontario.

1p. Feed Quality Parameters for Grain Corn and Corn Silage

OCC Priority # 7

Directed to: ARIO, AAFC, OARSC

Background: Approximately, seventy-five percent of the corn produced in Ontario is fed to livestock or poultry, either as grain or as whole plant silage. Thus, the ultimate value of corn is determined by efficiency with which corn is converted to meat and other livestock products relative to other sources of feed. Corn serves primarily as a source of energy, yet relatively little is known about the effect of the forms of energy that are being bred into corn lines (e.g. the different forms of starch; high-oil; etc.) on the performance of different species and classes of livestock and poultry. Initial work with steers at Ridgetown has shown significant advantages to diets high in silage produced from new silage hybrids.

A multi-disciplinary program is needed to:

1) Design and conduct feeding and laboratory trials, as appropriate, to investigate the relative importance of nutritional and physical characteristics, both natural and *value-added, of grain corn and corn silage for animal performance.
2) Characterize grain corn hybrids relative to important traits identified above.
3) Develop economical analytical methods for these traits to assist in ration balancing.
4) Breed lines of corn with superior yield and feeding value.

This work is envisioned as a co-operative program among corn breeders, cereal chemists, and animal nutritionists, in both the private and public sectors, and producer groups, using existing facilities. Funding would be required to provide overall co-ordination for the program as well as to support the component projects.

1q. BREEDING FOR YIELD AND STABILITY IN CANOLA

OOPSCC Priority #4

Directed to: ARIO

Background: With the introduction of new, adapted varieties for the Ontario market, the potential exists for expanded acreage in both spring and winter markets. Although canola and soybeans do not make an ideal rotation it is considerably better than bean after bean cropping sequence.

Continued need for improved varieties from an agronomic standpoint (disease, yield, etc.) as well as developing varieties with specific end use markets (special oils, industrial uses, etc.) This can be in balance with growing soybean acreage.

Recommendation 2

Issue/Strategic Direction: Agronomic Technologies for improved production efficiency.

Source: All subcommittees / Ontario Field Crop Research Coalition

OASCC Linkages: OPMRSC, OSWARC

Target Agencies: ARIO, AAFC, CARC

Similar to recommendation # 1, this strategic direction includes all field crops important to Ontario Agriculture and covers a wide range of activities from tillage systems, nitrogen and nutrient-use efficiency, rotation, management systems, variable rate technology and others. The role of this research is to improve production efficiency leading to a reduction in per output unit costs ($/bu). The details provided identify current thrusts of this research. By nature, these projects tend to be more short-term than those of breeding and biotech.

2a Nitrogen Use Efficiency in Corn

OCC Priority # 3

Directed to: ARIO, AAFC, OSWARC

Background: Nitrogen fertilizer represents a major input cost in corn production, is a significant component in many animal manures, and has the potential to adversely affect the quality of surface water and groundwater, if it is not managed appropriately. Continued research is needed to develop means to improve the utilization of nitrogen applied for corn production, as a means to reduce the amount applied while maintaining or increasing crop productivity. Variable-rate application must be one means of reducing nitrogen usage, but current techniques are inadequate for characterizing a field's nitrogen distribution and availability.

Characterizing a field using the soil nitrate test is inconvenient and expensive, because of the number of samples required to accurately describe the spatial and temporal variability in soil nitrate levels. A simpler, affordable alternative needs to be developed.

Preliminary work in the USA suggests the nitrogen status of corn leaves, early in the growing season, could be a useful indicator of overall crop nitrogen requirements. Research needs to be initiated to evaluate techniques for measuring crop nitrogen status under Ontario conditions. This must include an investigation of the effect of weather and soil variables on crop nitrogen uptake, growth and yield. In addition, the efficiency of N utilization of modern hybrids should be compared to hybrids of

15-20 years ago; to determine the accuracy for today's hybrids of N recommendations developed at that time.

Funding is required to provide additional technical support at the University of Guelph an ECORC.

2b. MANAGING CLIMATE-RELATED RISK IN PERENNIAL FORAGE CROPS:

II) Develop management techniques for improved winter survival of conventional and genetically altered alfalfa, and develop management techniques to enhance production of grasses during drought conditions.

OFCC Priority # 1

Directed to: ARIO and AAFC

Background: Perennial forages occupy more farmland than any other crop in Ontario. They provide the feed base for virtually all dairy, beef, sheep, goat, horse and ungulate farms. Although winterkill was of minor significance in most parts of Ontario last winter, producers are still concerned and fear another bad winter will result in a shortage of hay and higher prices. Since a secure supply of forage is critical to the operation of these industries, the OFCC feels that researchers have to concentrate more effort on methods to ensure that forage supply will be adequate.

Forage and livestock producers have stated quite clearly that climate related issues, especially winter-kill of alfalfa, are their number one concern. Genetic progress in alfalfa over the past 20 years has focussed on disease resistance, increased yields, and improved quality. However, specific efforts are required, by conventional or biotechnology means, to improve winterhardiness of alfalfa without deterring from other traits, especially yield, that have been improved in the past. To complement this work, improvements in the winterhardiness of orchardgrass should be made, since this grass is increasing in use with alfalfa and is the key grass species used in sown pastures in much of the province.

In addition to genetic improvements, producers want management techniques that improve the continuity of forage supply over the growing season. This would include techniques in pasture management to even forage supply during spring and summer, cope with dry weather and extend the grazing season in the fall. For stored forages, efforts should be concentrated on ensuring that management techniques are properly matched with the needs of new genetic material introduced into the marketplace. When new traits are introduced to alfalfa or other species, the management package may need to be re-evaluated. In other cases, what is considered normal management may need to change to better ensure winter-survival of currently-used varieties.

The OFCC recommends that research be directed at ensuring the security and continuity of forage supply with respect to climate-related risk through improved genetics and management practices.

2c. IMPROVING FEEDING VALUE OF FORAGES FOR STORED FEED AND PASTURE:

II) Management of forage crops to optimize feeding potential.

OFCC Priority #2

Directed to: ARIO

Background: High quality forage is the engine that drives the dairy industry in Ontario. Similarly, the beef and sheep industries rely to a great extent on high quality pasture and hay to ensure both milk production and proper rebreeding. Efforts to increase quality in both stored feed and pasture must be made to ensure that increased animal performance can be achieved from forages.

Alfalfa is the main stored forage used in Ontario. It supplies adequate amounts of crude protein when harvested at the correct stage of maturity, but is significantly lower in energy than grains such as corn or barley. Alfalfa that has been selected or genetically-modified to have higher digestible energy content would allow it to fill a higher proportion of the ration for milking cows and thus reduce feed costs. Progress has been made in the production and assessment of alfalfa varieties with reduced NDF levels and increase cell wall digestibility. Another area of interest would be to modify the types of protein found in common forage plants.

High quality forage harvested as pasture can be a very economical method to background beef cattle, develop beef and dairy breeding heifers, and grow market lambs. If these enterprises are to grow and prosper, more emphasis needs to be placed on managing the pasture resource to produce higher quality forage. Researchers need to focus on the forage quality requirements of the whole farm to integrate various methods and times of forage harvest into one complete system. Annual forage crops for stored feed or grazing should be considered here as well. The goal of the complete forage system should be to provide the maximum amount of nutrition from forages on a year round basis, supplementing with other feed sources only when the forage resource cannot provide those nutrients.

New species of forages need to be investigated for their ability to provide high quality forage in either pasture or stored feed systems. Before new types of alfalfa or other species are introduced to the marketplace, work should be done to ensure they can provide similar quality to existing material or else determine what management regime is needed to achieve the desired quality.

The OFCC recommends that research be directed at improving forage quality through genetic improvements, changes in management practices, or evaluation of new species.

2d Protein Content of Non-Pastry Wheats

OCCC Priority # 3

Directed to: ARIO, AAFC

Background: The protein content of non-pastry (a.k.a. milling, bread or hard red) wheats is critical to their end use and marketing.

Research on nitrogen management to increase the protein content of hard red winter wheat is underway. This is a co-operative project between OMAFRA, C & M Seeds, W. G. Thompson and Sons. U. of G. and Agriculture and Agri-Food Canada. Results have been inconsistent between sites. Generally, optimal growing conditions lead to high yields of lower protein wheat. Some sites have much more response w.r.t. protein with additional nitrogen application. These sites should be evaluated for parameters such as organic matter, rotation and manure inputs, to further predict optional locations for production of this wheat class. There are a very limited number of varieties available to growers that meet the needs of the industry.

Continuation of the research on nitrogen application to non-pastry winters is necessary to ensure that a larger percentage of the crop consistently meets the protein requirements without causing undue harm to the groundwater. Also, further work on the protein quality needs to be added to further enhance baking parameters beyond the agronomic practices.

Economic Importance: Premiums paid by the Ontario Wheat Producers' Marketing Board (OWPMB) encourage growers to produce hard red winter wheat with protein contents over 11.5%. These premiums range from $7/tonne for wheat at 11.5% protein to $18/tonne for wheat with protein over 12.5%. The OWPMB expects to market 90,000 tonnes of non-pastry winter wheat in 1996-97. Initial payment for non-pastry wheats are $25/tonne over those for pastry wheats and the markets are primarily domestic vs. export for the non-pastry wheats.

Nitrogen prices are high. Excess N applied beyond the need of the crop reduces profit.

Environmental Benefits: Nitrate contamination of groundwater is a concern if farmers who are trying to achieve protein contents that pay premiums apply nitrogen in excess of crop requirements.
Social Benefits: Non-pastry wheats produced in Ontario displace those brought into the province by millers. Non-pastry wheats displace acreage of pastry wheats thereby shifting marketing from import/export volatility to self sufficiency/export.

Competitiveness: Returns to farmers are greater from non-pastry wheats than from pastry types and displace imports (primarily from the west).

2e. Assessment of Rotation Benefits

OCCC Priority # 5

Directed to: ARIO, AAFC, OSWARC, OPMRSC

Background: Many producers base cropping plans on maximizing the net return on every acre. In the past, this led to continuous corn. Currently, the trend to multi-year soybeans with occasional break crops is becoming evident, with the expected related problems just now with developing: soybean

cyst nematode, potential new races of phytophthora, higher incidence of the rhizoctonia and pythium, etc.

While some data exists to value cereals in the rotation with corn (Vyn, Young), virtually no research is currently available to value cereals in the rotation with soybeans. This information is essential to maintain the productivity of our soils over the long term.

Also, herbicide carryover impacts on cereal crops, especially wheat, are constantly being discussed. The Ontario Weed Committee should further investigate these concerns.

Economic Importance: Yield loses to continuous monoculture may be as high as 20%. If 50% of the soybean acreage was affected even at a 10% level, economic returns to the producer could approach $50 million dollars annually.

Environmental and Social Benefits: All would benefit from the rotation opportunity of reduced herbicide inputs, other herbicide timing options, improved soil quality and reduced erosion.

Competitiveness: Competitiveness would be retained by maintaining high yields in each crop, and avoiding the pitfalls associated with monoculture.

2f. DEVELOPMENT OF AGRONOMIC PRACTICES THAT UTILIZE INNOVATIVE TECHNOLOGIES, ENHANCE SUSTAINABLE PRODUCTION, AND EXPLOIT THE YIELD POTENTIAL OF NEW CULTIVARS IN SOYBEANS.

OOPSCC Priority # 8
Directed to: ARIO, AAFC

Background: Significant improvements have been made in the yield potential of soybean varieties. This improvement has been made with little attention to changes in production practices. Research is required on production systems involving improved varieties. Environmental pressures are shifting production practices towards minimal application of herbicides, fertilizers, or pesticides. Reduced tillage could result in a 30-35% savings in land preparation costs and narrow rows may increase yields 5-10%.

Background: Over the past 15 years significant changes have occurred in Ontario soybean production practices. Four of the principal trends are as follows:

1. Increased acreage- The total soybean acreage planted has increased significantly over the past 15 years. This resulted from expansion of the soybean producing area in the north and east and reduced rotation in traditional growing areas.

2. Narrower rows- Soybeans were traditionally grown in 30 inch rows but the majority of soybeans within the province are now grown at a variety of row widths below 25 inches.

Narrow rows affect the climate within the crop canopy and can have an effect on weed populations and foliar and root diseases.

3. Reduced tillage- Soybeans are readily adapted to a variety of tillage practices. The development of no-till seed drills has facilitated reduced tillage for soybeans especially in the shorter season areas of the province. Production difficulties have occurred with reduced tillage on fine textured soils. The causes of these difficulties have not been identified. Soil structure, soil moisture, and plant diseases may be factors.

4. Reduced rotation- Soybeans are included more frequently in crop rotations especially in southwestern Ontario. The effect of this practice on soil structure, fertility, weeds, and diseases requires additional research.

2g. Tillage Systems, Planting Dates, Winter Wheat Survival

OCCC Priority # 7

Directed to: ARIO, AAFC, OSWARC

Background: Ontario farmers have adopted minimum tillage systems in attempting to preserve soil quality, reduce erosion and improve profitability. The effects of various tillage systems on the survival of winter wheat is not known. These tillage systems may also interact with planting date criteria. There is also concern over the validity of current planting date data, and this should be verified given the major economic impact potential.

Economic Importance: Reduced tillage systems require specialized equipment. If specific systems enhance or do not affect winter wheat survival, farmers can reduce the large cost of a trial and error approach. The cost of re-seeding to annual crops will be minimized. The prediction of winter wheat acreage made in the fall will be more accurate for the harvest year thereby allowing better forecasting of market situations. As the relationship of planting dates to this scenario becomes better understood, yield estimates can be further enhanced. Producers will also be better able to determine at what time to no longer seed wheat in the fall.

Environmental and Social Benefits: Some conservation tillage systems may have no effect or even enhance winter wheat survival. Demonstrating such will encourage adoption of these tillage systems.

Competitiveness: Reduced costs of production/crop insurance claims will put Ontario producers in a more competitive situation considering most of the winter wheat grown in the province is exported. Increased yields from proper planting dates will further enhance competitiveness.

2h. Agronomic Improvement of White and Coloured Beans
OPC Priority # 2

Directed to: ARIO, AAFC

The objectives are to increase yield and crop quality, to improve efficiency in pest management, and to increase net returns to the grower and/or decrease the cost of production through efficient production practices.

Evaluation of New Seed Treatments for the Control of Early Season Root Rot in Edible Beans. A new generation of seed treatments are being developed that provide a new level of control of early season pests such as root rots. One of these new products is called Maxim, which is produced by Norvartis. It has been registered for use in field corn. The research work in soybeans is limited to date and research work in edible beans is almost nonexistent. Novartis feels that Maxim could provide some control of root rots in edible beans.

There is also the concern over the deregistration of currently used seed treatment products (e.g. Captan) by the Environmental Protection Agency in the U.S. This could result in the manufacturer of these seed treatments removing these products from the Canadian market, which is usually considered insignificant versus the U.S. farm market. Even if Canadian farmers continue to have access to these products, the use of these products by Canadian edible bean growers could lead to non-tariff barriers for Canadian dry edible beans attempting to enter the U.S. market.

The primary focus of the study is to test the ability of the new seed treatment products to provide visual root rot control, and provide a significant yield increase. Very hot and dry weather conditions in 1998 resulted in limited root rot infection, very little significant differences existed for this parameter. A significant differences between varieties (Factor A) was documented at the Harrow site. However, this was likely due to differences in the tolerance of the varieties to root rot. Although there were no significant differences between seed treatments, most provided a better root rot rating than the untreated control. There were no significant differences in yield at the Huron site. Again, this suggests that none of the new products tested had any effect on delaying plant growth and development. The yields were below average at this site, due to the hot dry summer. At the Harrow site, seed yields were very poor, again due to the hot dry weather conditions in the summer of 1998. Significant yield differences occurred between varieties, with the navy types providing higher yields. Ho vever, this is typically the case, especially under high stress conditions.

2) Effects of Mechanical Damage on the Seed Coat Quality of White Beans

This research is being driven by concern within the bean industry that some white bean varieties are more susceptible to seed coat damage from mechanical means i.e. during harvest and post harvest handling. This is very recent work, and only two years of data has been summarized. Significant differences in mechanical damage have been shown to exist between varieties. Once the 1998 data has been summarized, a decision may then be made to remove varieties with poor mechanical damage performance from the list of recommended varieties. This data could also be used to inform growers of varieties that are generally more susceptible to mechanical damage, so that growers can take steps

to minimize any damage during harvest. One other use for the data is to identify varieties with superior resistance to mechanical damage. These varieties may then be isolated using an identity preserved program, with price premiums paid to the grower. There is strong interest from the Ontario Bean Producers Marketing Board to incorporate this testing into the yearly quality testing of white bean breeding lines for registration support to identify below and above average breeding lines earlier in the variety development process.

2I IMPROVE THE PRODUCTION EFFICIENCY OF CANOLA

OOPSCC Priority #5

Directed to: ARIO

Background: Improving the productivity of canola in Ontario requires research in the following areas:

1. Ontario growers need a program which identifies the best hybrids and varieties coming from Western Canada, Ontario, and other countries.
2. Agronomic studies to determine nutrient requirements, efficient tillage systems, cropping systems, and varietal response to no-till.
3. Controls to reduce damage from insects (flea beetles) and disease (Alternaria and white mould).
4. Increase winter hardiness of winter canola.

Background: The spring canola crop is worth $12 million per year in Ontario. The prospect of inexpensive , broad-spectrum weed control, higher yielding varieties, $400/tonne prices and an available market make this an attractive cash crop for the short-season areas of Ontario in which growers have few cash crop options. However, canola has had little agronomic research in Ontario. Studies designed to: i) determine the nutrient requirements of high yielding requirements hybrids, ii) test more efficient planting systems such as no-till and iii) varietal response to no-till, iv) develop methods of controlling damage from flea beetles and Sclerotinia. In 1996, herbicide-tolerant canola varieties were available, yet little Ontario research has been done on cropping systems. Some data suggests that a glufosinate-tolerant variety is very susceptible to Alternaria. This could cause major problems if this variety is grown in the presence of the disease of the disease. Research is also needed to pinpoint when canola should be sprayed to maximize weed control, and yet not miss late-emerging weeds.

There is also a major need to extend the winter hardiness of winter canola. This likely means incorporating transgenic characteristics. If the crop would survive across southern Ontario, it offers 30% higher yields than spring canola, overwinter erosion protection, a better distribution of seasonal workload for the growers, better canola quality, and harvesting in July.

2j. Cereal Nutrition Including Sulphur, Copper, Chlorine, and Nitrogen Effects on Yield, Protein Content, Quality and Diseases

OCCC Priority # 8

Directed to: ARIO, AAFC, OSWARC

Background: Quality and disease incidence must be studied as they apply to cereal nutrition in addition to the nutritional effects on yield. Quality is of increasing importance in global markets. The effects of the nutrients, sulphur, copper, chlorine, and nitrogen on quality and disease incidence need to be investigated.

2k. Cereal Management Including Row Width's, Seeding Rates, and Starter Fertilizers

OCCC Priority # 9

Directed to: ARIO, AAFC

Background: As other crops move towards narrow rows, producers are enthusiastic about the potential to use one planting tool for all crops. Logistics of this new system allow for 10" row spacing as the minimum. Some U.S. trials indicate the ability to reduce plant populations due to accuracy of seed placement with these systems. An evaluation of this technology is necessary.

The benefits of seed placed starter fertilizers have also been touted by industry and producers, and have been proven in other crops. However, the impact of this on cereals, along with the relationship of soil test levels to this practice, has not been determined. This evaluation should be conducted.

Economic Importance: Seeding rate reductions of 33% may be possible. This equates to a potential $10 million dollar savings to the grower. Yield increases of 4 bu./ac. may be possible with seed placed starter fertilizer. This opportunity could yield $14 million dollars for Ontario's producers.

2l Variable Rate Technology

OCCC Priority # 10

Directed to: ARIO, OSWARC

Background: The potential of site specific crop management and variable rate technology is tremendous. These investigations need to continue. This committee requests support of these efforts by the soil management sections within the OASCC system.

Recommendation 3

Issue / Strategic Direction: Plant and crop physiology

Sources: All sub-committees, Ontario Field Crop Research Coalition

OASCC Linkages: OHCRSC

Target Agencies: ARIO, AAFC, CARC

The research conducted and required within this strategic direction tends to be discovery and basic in nature. It covers a number of objectives designed to understand how a plant works, to identify important chemical pathways, genes, and traits. This direction reflects the absolute need for basic research to advance the science of crop production. Basic research in plant and crop physiology provides knowledge that opens new areas of applied science. It is important however, that this basic research be in a conceptual framework of leading to a useful application. Not just science for science sake, but science to understand and improve crop production.

3a. IMPROVED UTILIZATION OF NUTRIENTS (N2 FIXATION) IN SOYBEANS

OOPSCC Priority #6

Directed to: ARIO, AAFC

Background: Improve the efficiency of nitrogen fixation and nitrogen utilization by the following methods:

1. Evaluate inoculant products to advise growers which ones to use n new soybean land.
2. Test strains to identify the most efficient.
3. Develop methods for changing strains of soybean rhizobia in growers fields.
4. Increase soybean yields by devising novel methods to get more total N into the crop.
5. Determine whether other micro-organisms can enhance soybean yields or improve the efficiency of fertilizer use.

Background: The yield of soybean is N-limited. Accumulated N comes from soil available N or from N2 fixation. Increasing the rates of fertilization N applied to soybeans, however, inhibits nodule formation, nodule mass, and N2 fixation and also results in a reduced proportion of the total plant N accumulating in the seed. Increases in N2 fixation, on the other hand, cause substantial yield increases. A strain of soybean rhizobia called 532C was identified at Guelph in the mid-1980's. This strain fixed more N2 than previous strains under the same conditions. Strain 532C increased soybean

yields by 7 to 9 % each year. When 532C was introduced into new soybean soil, it persisted and maintained its efficiency. This strain now occupies about 15% of the soybean acreage in Ontario. If it increases yields by 8% on the 15% of the acreage and the Ontario soybean crop is worth $500 million per year, strain 532C increases the value of the Ontario soybean crop by $6 million annually with no added inputs. Its value also continues to rise as new acres are inoculated with this more efficient strain.

Over the past 4 years, detailed studies have been conducted on why recently-released soybean varieties outyield older varieties when they are planted in the same field. Surprisingly, one of the answers is that newer soybeans are much more efficient at accumulating available soil N without decreasing their N2 fixation. These results suggest that one of the keys to higher soybean yields is to understand how to manipulate available soil N while maintaining N2 fixation.

Recommendation 4

Issue / Strategic Direction: Variety Testing

Source: All subcommittees, Ontario Field Crop Research Coalition

OASCC Linkages: none

Target Agencies: ARIO, OMAFRA, AAFC

This strategic direction combines both research and service components. Clearly proper scientific methodologies must be applied in variety testing, but the end result of this research is primarily a service to producers and to the industry. In Ontario, variety testing comprises two components that are somewhat distinct and serve different functions. The first is registration testing. This testing provides data to support new varieties for registration (legal right to sell and produce seed by variety name) and depending upon the committee may be used as performance data. Performance testing is that testing which producers use to make variety choices. Over the last 18 months the Canadian Food Inspection Agency has conducted a review of registration testing and broad changes may be implemented in 2001. This will affect how this service component is conducted but in no way diminished its importance. In fact, as the requirements for registration are reduced or eliminated, the need for a strong and effective performance testing system becomes greater and there is wide-spread support for performance testing among producers and the industry. The current system for registration testing is essentially 100% cost recovery in all crops while most performance testing systems are partnerships among the University of Guelph, the regional Colleges, AAFC, industry and producers. A very strong performance testing system is important, as wrong decisions on variety/hybrid choice are costly. Under an extremely conservative scenario where just 1 in 10 producers chooses the wrong variety and it costs them 2% in yield loss, the impact to the entire sector in loss farm gate receipts is in excess of $ 50 million. Obviously the potential for economic loss could be extremely high and this underpins the requirement for solid and reliable performance data for producers.

4a. Assessment of Performance Testing Systems

OCC Priority # 6

Directed to: ARIO, AAFC, OMAFRA

Background: Producers base most of their variety decisions on information they receive from provincial performance data, along with company information and their own experience. With the move to fiscal restraint, the level of performance testing has been greatly curtailed within the cereal crop sector. The impact this will have on the validity of the data presented to the farmer is unknown.

Concurrently to this reduction of testing, other sources of information are becoming available from farmer strip trials and combine yield monitors. Again, the validity of this data is unknown.

An investigation of this data, and a determination of what is required to have valid information to give the producer, is essential. The committee suggests that Guelph undertake this project, and enlist help from whatever other sources are required.

Economic Importance: Selecting the proper variety is the number one factor in grower profitability. Selecting an inferior variety, with as little yield differential as 2 bu./ac., would cost the Ontario producer 7 million dollars across the province.

4b CONTINUE AND IMPROVE THE PUBLIC SYSTEM OF FORAGE VARIETY TESTING IN COOPERATION WITH INDUSTRY STAKEHOLDERS.

OFCC Priority #3

Directed to: ARIO, AAFC, OMAFRA

Background: The OFCC has been conducting unbiased evaluation of varieties for yield and persistence since the committee was established in 1956. The work was undertaken to: i) Identify the varieties which merit use by forage producers in Ontario ii) Provide relative performance information among forage varieties available in the marketplace, and iii) Provide data to Canadian Food Inspection Agency to allow the legal sale of these varieties. In 1991, the OFCC was the first provincial recommending committee to undertake quality evaluation of forage varieties in addition to yield performance. Forage yields and quality samples are collected from OFCC registration trials at public testing centres. The OFCC worked with the Seed Trade and the Canadian Food Inspection Agency during 1997 to improve the system of support for variety registration. This will allow varieties that meet OFCC performance criteria to be supported for registration using some or all data from outside Ontario. This will allow producers to have access to these varieties 2 years earlier than under the previous system. The OFCC still conducts performance testing and still provides performance data from public trials in Ontario to producers as in the past. A significant change could occur over the next year as the CFIA has proposed that merit-based registration be eliminated for all forage crop species. This could significantly affect the performance testing system since new varieties would no longer have a legal requirement to be tested in public Ontario tests. The OFCC is working out strategies to deal with this eventuality and is seeking views from other stakeholders as to how the performance testing system might be continued.

Service Priorities

Issue/Strategic Direction: Delivery Methods

Source: All Committees, Ontario Field Crop Research Coalition

OASCC Linkages: All committees

Targeted Agencies: OMAFRA, AAFC

It is important that the products of research are used by the clients that need it, otherwise the research itself is meaningless. In the field crop sector the results of research are disseminated in a wide variety of ways from publications, meetings, web-sites, and by interactions of all kinds. The clearer and the more understandable the outcomes of research can be made, the greater will be the proper uptake and utilization. A number of success stories in technology transfer are being documented. The new Ontario Soil and Crop Improvement Association web-site with variety performance information for corn, soybeans and wheat has tremendous potential as a tool to work in concert with the Ontario Performance Trials in those crops to assist growers with their variety choices. The lead positions created by OMAFRA are making an impact in Ontario and the team approach between research and extension fostered by the OASCC committees should be encouraged.

Strategic Directions and Resource Shifts.

The above strategic directions represent research currently underway and funded by a wide-range of public and private funding sources. These directions, based on the mandate of the Ontario Field Crop Research and Services Committee, are the areas of greatest need and impact and they have wide industry support. In the section on Sector scans, each commodity area identified a number of issues facing their committees and the commodities that they represent. It is in these areas that those responsible for resource reallocation should look. For example, a considerable effort over the last several years has been focused on Fusarium in corn and wheat. And there have been success – identification of hybrids with some tolerance and the registration of Folicur , a fungicide for control of Fusarium in wheat. However, 1999 showed that we do not really know very much about the organism (or at least not enough). Most experts predicted severe potential problems for wheat (there were essentially none) and no problems for corn (and there were lots). It was a surprise. In addition, the screening test for Fusarium appears at best to be erratic and if significant improvement in breeding for rst./tolerance is to be made, a simple, reliable and repeatable test is required. It is clear that more work is needed in this area.

Both the Forage committee and the Corn committee have noted that corn silage as a feed source has changed with the introduction of new hybrids with greater digestibility and feed value. There has been some preliminary work done with feeding trials using these new silage hybrids and the results have been very encouraging. There is renewed interest in corn silage among growers, but the information on agronomic performance and animal utilization is scant. This area has the potential to allow for significant increases in productivity and efficiency.

Many of Ontario's field crops have tremendous potential for premium-based niche production opportunities. Success in this area with soybeans provides Ontario with some experience and infrastructure-based advantages. There appear to be a number of opportunities for wheat in Ontario to meet changing market demands, but the entire industry needs to collaborate on any shifts to ensure that the required processing traits can be consistently meet. There have been some encouraging and initial successes with food-grade corn specifically the production and processing of white corn in Ontario. This research has been primarily "soft-funded" and the potential for a new industry from a grower perspective warrants consideration of base-funding shifts to continue these efforts. The production of new market classes of coloured beans and the development of export markets also provides a potential new opportunity for Ontario. We can successfully grow a number of coloured bean types quite well and further diversification in this area is being promoted by the industry. Clearly issues of quality are becoming increasingly important in the edible bean sector, particularly, but not exclusively in white beans.

Appendices:

Appendix 1.

FCRSC Report on Industry-Funded Tobacco Research

The Ontario Tobacco Committee (OTC) reports through FCRSC. At the December 1999 meeting, a list of research priorities identified by the production and variety subcommittees of the OTC were provided and these are attached for information purposes only. The research on tobacco is proceeding mainly with funding from the industry through the Canadian Tobacco Research Foundation. Research priorities are established and projects are funded by CTRF, based on advice from the Foundation Advisory Committee.

The following list (descending order) of research the tobacco production practices sub-committee-identified priorities.

1- Evaluate the effects of a forage millet and tobacco rotation on soil nematode populations and tobacco yield and quality.

2- Further develop the float tray system for producing seedlings in Ontario with emphasis on 1) determining methods to dispose of spent float water in an environmentally friendly manner, 2) determining pest management strategies and 3) evaluating the applicability of the ebb and flow method.

3- Identify the cause(s) and solutions(s) of tobacco bruising

4- Evaluate the efficacy of direct measurement of weight loss as a curing control technique

5- Identify curing conditions for specific types of harvested tobacco that optimize the curing process and cured quality.

6- Screen winter rye varieties for superior grain and straw yields.

7- Herbicide screening for control of weeds in marigolds and forage millet where marigold and forage millet are used as a rotation crop for tobacco to suppress nematode populations.

8- Improve seed viability and initial plant vigour of marigolds where marigold are used as a rotation crop for tobacco to suppress nematode populations.

The following list (descending order) of research priorities was identified by flue-cured tobacco variety registration sub-committee.

1- Development of better quality tobacco with reasonable yield level and high AM & O@ grades.

2- Development of resistant cultivars to diseases such as black root rot and blue mold and to insects such as aphids using both conventional and non-conventional approaches.

3- Development of alternate uses of tobacco

Appendix 2: Report of Action Taken on Previous Recommendations

Field Crops Research and Services Committee

ARIO Response - Research Priorities

ARIO recognizes the research priorities for field crop research that have been identified in the recommendations from the Field Crops Research and Services Committee and its subcommittees. The four main research priorities of field crop breeding and biotechnology, agronomic technologies, plant and crop physiology and variety testing are being addressed within the Plants program at the University of Guelph. In addition, support is provided for areas of these priorities such as site-specific farming, tillage and fertility in the Agri-Food System Resources and Environment program, which was presented to ARIO. Project selection for this program is currently underway. Details of the program can be obtained from the director Dr. Michael Goss. The program proposal for 1999-2003 is available from the University's web-site.

Research to address field crop priorities is also supported through programs such as FS2002 and the Special Research Fund. This year's Special Research allocation included funding for biotechnology and alternative crops and new uses as well as processing of existing crops.

The limited human and financial resources which are available to support agricultural research dictate that all priorities cannot be addressed simultaneously. In order for new priorities to be addressed or additional resources given to existing research, projects which are underway must be either scaled back or completed so that the needed resources can be reallocated. OASCC committees can assist this process by identifying their top priorities as well those areas or research which require less emphasis.

A process is being developed to redirect resources within the Enhanced Partnership Agreement to high priority areas which are not being adequately addressed. Clear identification of priorities by OASCC committees will facilitate this process

Service Priorities

FCRSC Service Recommendation 1: To develop innovative extension methods to collect and disseminate forage information.

OMAFRA response (Agriculture and Rural Division)

The ministry has a forage team with multi-disciplinary membership drawn from Livestock and Soil and Crop advisory staff. The team addresses forage issues in a co-ordinated approach. The information compiled is disseminated in print and electronic formats or delivered through presentations at meetings.

We support this recommendation and will send copies of the recommendation and ministry response to the forage team.

Appendix 3. Summary of Distribution of Recommendations

SUMMARY OF DISTRIBUTION OF RECOMMENDATIONS

Recommendation	AAFC	ARIO	CC	CARC	OMAFRA	OTHER
1. Field Crop Breeding & Biotech	✔	✔		✔		OPMRSC
2. Agronomic Technologies OSWARC	✔	✔		✔		
3. Plant & Crop Physiology	✔	✔		✔		
4. Variety Testing	✔	✔			✔	
Service						
1. Delivery Methods	✔				✔	

Appendix D: Committee Memberships

ONTARIO FIELD CROP RESEARCH & SERVICES COMMITTEE

Mr. John Madill, Chair
OFFC
Box 2003
KEMPTVILLE, Ontario
K0G 1J0
Tel: (613) 258-8444
Fax: (613) 258-8401

Mr. Bill Curnoe
Kemptville College
Box 2003
KEMPTVILLE, Ontario
K0G 1J0
Tel: (613) 258-8333
Fax: (613) 258-8477

Mr. Don McCabe
OCPA
R.R. #1
INWOOD, Ontario
N0N 1K0
Tel: (519) 844-2482
Fax: (519) 844-2603

Mr. Brian Hall
OCC – OMAFRA
Box 159,
CLINTON, Ontario
N0M 1L0
Tel: (519) 482-3428
Fax: (519) 482-5031

Mr. Brian Kennedy
OMAFRA
1 Stone Road W.,
GUELPH, Ontario
N1G 4Y2
Tel: (519) 826-3257
Fax: (519) 826-3567

Mr. Rob Roy, Chair
OPC
Box 186
DELHI, Ontario
N4B 2W9
Tel: (519) 582-1950, Ext. 252
Fax: (519) 582-4223

Mr. Greg Devries
OSGMB
R.R. #6
DRESDEN, Ontario
N0P 1M0
Tel: (519) 683-1004
Fax: (519) 683-4587

Mr. Rob Templeman
OPPSC-OMAFRA
581 Huron Street
STRATFORD, Ontario
N5A 5X8
Tel: (519) 271-0280
Fax: (519) 273-5278

Mr. Ken Hough
OCPA
90 Woodlawn Road
GUELPH, Ontario
N1H 1B4
Tel: (519) 837-1660
Fax: (519) 837-1674

Mr. Hussein Haji
CTRF
Box 186
DELHI, Ontario
N4B 2W9
Tel: (519) 582-1950, Ext. 257
Fax: (519) 582-4223

Ms. Janet Parsons
ARIO
1450 Gauthier Road
CACHE BAY, Ontario
P0H 1G0
Tel: (705) 753-0730
Fax: (705) 753-4424

Dr. Dave Hume, Director - Research
University of Guelph
1 Stone Road W.,
GUELPH, Ontario
N1G 4Y2
Tel: (519) 826-3880
Fax: (519) 826-4211

Mr. Peter Johnson
OCCC
670 Exeter Road
LONDON, Ontario
N6E 1L3
Tel: (519) 873-4070
Fax: (519) 873-4062

Mr. Dennis Jack
OCPA
R.R. #1
THAMESVILLE, Ontario
N0P 2K0
Tel: (519) 692-5242
Fax: (519) 692-5618

Mr. Claire Sherk
OWB
336 Cty. Rd. 14,
COTTAM, Ontario
N0R 1B0
Tel: (519) 839-4208
Fax: (519) 839-4846

Mr. Gary Whitfield
AAFC – Harrow
AAFC Research Centre
HARROW, Ontario
N0K 1G0
Tel: (519) 738-2251, Ext. 402
Fax: (519) 738-3756

Dr. Gary Ablett, Chair
Ridgetown College-Univ. of Guelph
Main Street East
RIDGETOWN, Ontario
N0P 2C0
(519) 674-1505
(519) 674-1515

Mr. Ralph Baumlisberger
OCGA
R.R.
GRAND VALLEY, Ontario
L0N 1G0
Tel: (519) 928-2949
Fax: (519) 928-3180

Mr. Frank Marks
AAFC
Sandford Street
LONDON, Ontario

Tel: (519) 457-1470
Fax: (519) 457-

Ontario Corn Committee

Executive - Ontario Corn Committee (September 1999)

Name	Affiliation	Address
Mr. Brian Hall	**OMAFRA (chair)**	**Box 159, 100 Don St., Clinton, N0M 1L0**
Mr. David Morris	OCC, Secretary	Box 104, 10 Cambria Rd., Markdale, N0C 1H0
Mr. Ken Hough	OCPA (Alt)	90 Woodlawn Road W., Guelph N1H 1B2
Mr. Kevin Ferguson	OSCIA (alt.)	6544 Dalmeny Rd, Osgoode, Ont. K0A 2W0
Mr. Lloyd Crowe	OSCIA	RR #8, Picton, ON K0K 2T0
Mr. Greg Stewart	OMAFRA (alt)	Plant Agric. Dept. , U of G, Guelph, N1G 2W1
Dr. Lana Reid	Agric. & Agri-Food Canada	ECORC, Bldg. 99 CEF, Ottawa
Dr. Lianne Dwyer	Agric. & Agri-Food Canada	ECORC, 960 Carling Ave. CEF, Ottawa, ON 6
Mr. Garry Hoekstra	Kemptville College	Kemptville, ON K0G 1J0
Dr. Liz Lee	Plant Agric. Dept.	University of Guelph, Guelph, ON N1G 2W1
Ms. Louise Duke	(CFIA)	59 Camelot Dr., Nepean, ON K1A 0Y9
Mr. Dean Martin	Seed Corn Growers' Mktg. Bd.	RR #5, Harrow, Ontario N0R 1G0
Mr. Larry Cowan	OCPA	RR #1, Mount Brydges, ON N0L 1W0
Mr. Tom Welacky	GPCRC	Harrow, ON N0R 1G0
Dr. Francis Glenn	CPBA, Glenn Seeds Ltd.	RR #1, Blenheim, ON N0P 1A0
Mr. David Scott	Pioneer Hi-Bred Limited	Box 730, #2 Hwy.W., Chatham, ON N7M
Mr. Doug Knight	Novartis Seeds Inc.	RR # 1, 15910 Medway Rd. Arva, N0M 1C0
Mr. Steve Hasak	W. G. Thompson & Sons	Box 130, Blenheim, ON N0P 1A0
Dr. Arend Smid	Ridgetown College	Ridgetown, Ont. N0P 2C0
Mr. Randy Ross	Ridgetown College	Box 1258, Ridgetown, Ont. N0P 2C0

ONTARIO FORAGE CROPS COMMITTEE
MEMBERSHIP OF CENTRAL AND SUB-COMMITTEES, 1999

OFCC Central Committee Membership- 1999-2000	
Mr. John Madill, Chair 1999-2001 Kemptville College, U of Guelph Kemptville, ON K0G 1J0 Ph: (613) 258-8336 Fax:613-258-8401 email: jemadill@magi.com	Mr. Jim Johnston - Secretary 1999-2001 New Liskeard Agr. Res. Stn., U. of Guelph Box G, New Liskeard, P0J 1P0 Ph: (705) 647-8525 Fx: (705) 647-9220 email jimjohn@onlink.net
vacant - Ontario Soil and Crop Improvement Association	Mr. Felix Mederick, Canadian Seed Trade Association Oseco/ABT., R.R.#2, Brampton, ON L6V 1A1 Ph:(905) 846-5080 Fx: (905) 846-6909
Mr. Jay Hackney – Commercial Plant Breeders Rep. Pickseed Canada Inc. ,1 Greenfield Rd. Lindsay, ON K9V 4S3 Ph: (705) 8789240 Fx: (705) 878-9249 email: jhackney@pickseed.com	Mr. Laurier Guillemette, AAFC Kapuskasing Experimental Farm, Box 160, Kapuskasing, ON P5N 2Y3 Ph: (705) 335-6148 Fx: (705) 337-6000 email: laurierg@ntl.sympatico.ca
Mr. Chris Gillard, Ridgetown College Ridgetown, ON N0P 2C0 Ph: (519) 674-1632 email: cgillard@ridgetownc.uoguelph.ca	Mr. Bruce Whale, Ontario Forage Council Clovermead Farms R.R.# 2, Alma, ON N0B 1A0 Ph: (519) 638-2230 Fx: (519) 638-5638 email: whale@wcl.on.ca

OFCC Production SubCommittee Membership 1999-2000	
Mr. Jim Johnston – Chair 1999-2001 New Liskeard Agr. Res. Stn., U. of Guelph Box G, New Liskeard, P0J 1P0 Ph: (705) 647-8525 Fx: (705) 647-9220 Email: jimjohn@onlink.net	Mr. John Madill, Secretary 1998 - 2000 Kemptville College, U of Guelph Kemptville, ON K0G 1J0 Ph: (613) 258-8336 Fax: 613-258-8401 email:jemadill@magi.com
Dr. E. Ann Clark – Crop Science U. of Guelph, Guelph, ON N1G 2W1 Ph: (519) 824-4120 ext.2508 Email: annclark@crop.uoguelph.ca	Mr. Bruce Whale; Ontario Forage Council Clovermead Farms R.R.# 2, Alma,ON N0B 1A0 Ph: (519) 638-2230 Fx: (519) 638-5638 email: whale@wcl.on.ca
Mr. Scott Banks, OMAFRA 26 Thorncliff Place, Nepean, ON K2H 6L2 Ph: 613-828-9167 Fx:613-828-6083 email: sbanks@omafra.gov.on.ca	Dr. Gabriel Roy, AAFC Kapuskasing Experimental Farm, Box 160, Kapuskasing, ON P5N 2Y3 Ph:(705) 335-6148 Fx: (705) 337-6000
Mr. Jean-Guy Seguin, Dairy Farmers of Ontario R.R.#1, Verner, ON P0H 2M0 Ph: (705) 696-2169 Fx: (705) 696-1427	Mr. Harvey Brown, Ontario Cattlemens Association 5664 Elgin Mills Rd. Markham, ON L3P 3J3 Ph& Fx: (905) 640-1117
Ms. Wendy Asbil, Kemptville College, UG Kemptville, ON K0G 1J0 Ph: 613-258-8336 Fax 613 258-8401 email: wasbil@kemptvillec.uoguelph.ca	To be announced - wildlife habitat rep.

Mr. Laurier Guillemette, Chair, 1998-2000 AAFC Kapuskasing Experimental Farm, Box 160, Kapuskasing, ON P5N 2Y3 Ph: (705) 335-6148 Fx: (705) 337-6000 email: laurierg@ntl.sympatico.ca	Mr. Jim Johnston - Secretary 1999-2001 New Liskeard Agr. Res. Stn., U. of Guelph Box G, New Liskeard, P0J 1P0 Ph: (705) 647-8525 Fx: (705) 647-9220 email: jimjohn@onlink.net
Dr. Steve Bowley, Crop Science, UofGuelph Guelph, ON N1G 2W1 Ph: (519) 824-4120 Fx: (519) 763-8933 email: sbowley@plant.uoguelph.ca	Ms. Donna Hancock, Crop Science Alternate U. of Guelph, Guelph, ON N1G 2W1 Ph: (519) 824-4120 Fx: (519) 763-8933 email: dhancock@plant.uoguelph.ca
Mr. Gordon Scheifele, Thunder Bay Res.Stn. University of Guelph 335 Euclid Ave. Thunder Bay, ON P7A 6G6 Ph: (807) 475-1373 Fx: 807-475-1219 email: gscheife@omafra.gov.on.ca	Mr. Chris Gillard, Ridgetown College Ridgetown, ON N0P 2C0 Ph: (519) 674-1632 email: cgillard@ridgetownc.uoguelph.ca
Mr. John Madill, Kemptville College, UofGuelph Kemptville, ON K0G 1J0 Ph: (613) 258-8336 Fx: 613-258-8401 email: jemadill@magi.com	Mr. Bob Hamilton, OMAFRA Wellington Place, R.R. # 1 Fergus, ON N1M 2W3 Ph:(519) 846-0941 Fx: (519) 846-8178 email: bhamilto@omafra.gov.on.ca
Mr. Eric Bowman, Ontario Soil and Crop Improvement Association, 1721 Reg. Rd. 3, Enniskillen, ON L0B 1J0 Ph: 905-263-8245 email: ebowman@idirect.com	Mr. John McGill, Ontario Seed Growers Assoc., R.R. # 4, Pakenham, ON K0A 2X0 Ph: (613) 256-2193 Fx: (613) 256-2528

Mr. Quentin Martin, Ontario Seed Growers Association – Alternate R. R. # 2, West Montrose, ON N0B 2V0 Ph: 519-644-3701 Fx: 519-644-1235	Mr. Felix Mederick, Canadian Seed Trade Association Oseco Inc., R.R.#2, Brampton, ON L6V 1A1 Ph:(905) 846-5080 Fx: (905) 846-6909
Mr. Tim Welbanks, Canadian Seed Trade Association – Alternate Pioneer Hi-Bred Ltd. Box 730, Chatham, ON N7M 5L1 Ph:(800) 265-9435 Fx: (519) 436-6753 email: welbanks@phibred.com	Mr. Jay Hackney - Commercial Plant Breeders Rep. Pickseed Canada Inc. 1 Greenfield Rd. Lindsay, ON K9V 4S3 Ph: (705) 8789240 Fx: (705) 878-9249 email: jhackney@pickseed.com
Mr. Eric Richter, Commercial Plant Breeders Rep – Alternate Novartis Inc. 115 Edgehill Cres. London, ON N6G 2T5 Fx: (519)-473-2690	Ontario Forage Council - vacant
Ms. Louise Duke, Observer Canadian Food Inspection Agency, Plant Products Division, Variety Registration 59 Camelot Dr. Nepean, ON K1A 0Y9 Ph: (613) 225-2342 Fx: (613) 228-6629 email: lduke@em.agr.ca	Ms. J. Lindo, Observer Canadian Food Inspection Agency Plant Products Division, Variety Registration 59 Camelot De., Nepean, ON K1A 0Y9 Ph: (613) 225-2342 Fx: (613) 228-6629 email: jlindo@em.agr.ca

Ontario Oil and Protein Seed Crop Committee Membership

VSC - Variety Subcommittee Members
ROC - Rest of Comm (VSC + ROC = OOPSCC with no duplicates)
CSS - Canadian Sponsor Soybean
CSC - Canadian Sponsor Canola

Dr Gary Ablett [RCAT]
3100 Area Co-ordinator
Ridgetown College, Univ. of Guelph
RIDGETOWN, Ontario
N0P 2C0
VSC
CSS
Tel: 519-674-1505
Fax: 519-674-1515
E-mail:
gablett@ridgetown.uoguelph.ca

Ms. Fe Aling
Canadian Food Inspection Agency
Variety Registration Office
59 Camelot Dr.,
NEPEAN, Ontario
K1A 0Y9
ROC
Tel: 613-952-8000 x 4391
Fax: 613-992-5219
E-mail: faling@em.agr.ca

Dr. Terry Anderson
Agriculture & Agri-Food Canada
Research Centre
HARROW, Ontario
N0R 1G0
VSC
Tel: 519-738-2251 x 426
Fax: 519-738-2929
E-mail: andersont@em.agr.ca

Mr. Dan Brown [ISGL; ASGP, OSGA,alt.]
Canadian Seed Growers Association
Inwood Seed and Grain Ltd.,
Box 130, James St.,
INWOOD, Ontario
N0N 1K0
VSC
CSS
Tel: 519-844-2426
Fax: 519-844-2424
E-mail:

Dr. Dick Buzzell
Treasurer
Agriculture & Agri-Food Canada
Research Centre
HARROW, Ontario
N0R 1G0
VSC
Tel: 519-738-2251 x 470
Fax: 519-738-2929
E-mail: buzzeld@wincom.net

Mr. John W. Clark
Canadian Grain Commission
Industry Services
P.O. Box 158
CHATHAM, Ontario
N7M 5K3
ROC
Tel: 519-436-3190
Fax: 519-436-3195
E-mail: jclark@cgc.ca

Mr. James Beer (OSGA Alt)
Ontario Seed Growers' Association
(Alt)
R.R.#4
ARTHUR, Ontario
N0G 1A0
VSC
Tel: 519-848-3488
Fax: 519-848-3857

Mr. Leigh Cohoe
Ontario Soil & Crop Improvement
Assoc.
R.R. #1
BURGESVILLE, Ont.
N0J 1C0
VSC
Tel: 519-424-9156
Fax: 519-424-9872
E-mail: lcohoe@oxford.net

Mr. Neil Driscoll
Ont. Canola Growers Association
R.R. #1
PALMERSTON, Ont.
N0G 2P0
VSC
Tel: 519-638-3252
Fax: 519-638-5420

Ms. Louise Duke [EXOF]
Canadian Food & Inspection Agency
Variety Registration Office
59 Camelot Dr.,
NEPEAN, Ont.
K1A 0Y9
VSC
Tel: 613-225-2342 x 4387
Fax: 613-228-6629

Dr. Elroy Cober [CORC]
Agriculture & Agri-Food Canada
ECORC, CEF Bldg. 110
OTTAWA, Ont.
K1A 0C6
VSC
CSS
Tel: 613-759-1610
Fax: 613-759-6597
E-mail: coberer@em.agr.ca

Mr. Ron Guillemette
2600 Area Co-ordinator
Agriculture & Agri-Food Canada
ECORC, CEF Bldg.110
OTTAWA, Ontario
K1A 0C6
VSC CSS
Tel: 613-759-1611
Fax: 613-759-6597
E-mail: guillemettr@em.agr.ca

Mr. Chris Gillard
Ridgetown College Univ. of Guelph
RIDGETOWN, Ont.
N0P 2C0
VSC
Tel: 519-674-1632
Fax: 519-674-1600
E-mail:
cgillard@ridgetownc.uoguelph.ca

Ms. Gail Harris / Mr. John Curtis
[EXOF]
SeCan Association
200-57 Auriga Dr.,
NEPEAN, Ontario
K2E 8B2
VSC
Tel: 613-225-6891
Fax: 613-225-6422
E-mail: secan@secan.com

Dr. Mark Gijzen
Agriculture & Agri-Food Canada
Pest Management research Centre
1391 Sandford St.,
LONDON, Ontario
N5V 4T3
ROC
Tel: 519-663-3552
Fax: 519-663-3454
E-mail: gijzenm@em.agr.ca

Mr. L. Hawkins [ZENS]
Zeneca Seeds
105 Queen St., West
ST. MARYS, Ontario
N4X 1A8
ROC
CSS
Tel: 519-284-0219
Fax: 519-284-0475

Mr. Alejandro Hernandez [FLSL]
First Line Seeds
R.R. #2
GUELPH, Ontario
N1H 6H8
VSC
CSS
Tel: 519-821-0882
Fax: 519-821-9755
E-mail: ahernandez@soybeans.com

Dr. Dave Hume
Canola Co-ordinator
Dept. of Plant Agriculture
University of Guelph
GUELPH, Ont.
N1G 2W1
VSC
Tel: 519-824-4120 x 3386
Fax: 519-763-8933
E-mail: dhume@crop.uoguelph.ca

Mr. Bob Hart (OSGA Alt) [PROS]
PRO Seeds of Canada
R.R. #6
WOODSTOCK, Ontario
VSC
CSS
Tel: 519-537-5157
888-537-5157
Fax: 519-537-5169
E-mail:bobhart@oxford.net

Mr. Raymond Legault
Ontario Seed Growers Assoc. (Alt)
R.R. #1
ST. ALBERT, Ontario
K0A 3C0
VSC
Tel:
Fax:
E-mail:

Dr. Howard Love
Svalof Weibull Seeds [CSTA-ALT]
P.O. Box 217
LINDSAY, Ontario
K9V 5Z4
VSC
CSS
CSC
Tel: 705-324-3293
Fax: 705-324-2550
E-mail:

Mr. John Madill
Kemptville College of Univ. of Guelph
KEMPTVILLE, Ontario
K0G 1J0
VSC
Tel: 613-258-8347
Fax: 613-258-8384
E-mail: jemadill@magi.com

Mr. Rene Petrowski
Ont. Soybean Grower's Marketing Board (Alt)
Box 1199
CHATHAM, Ontario
N7M 5L8
VSC
Tel: 519-352-7730
Fax: 519-352-8983
E-mail: siler@soybean.on.ca

Mr Brad Martin
Ontario Canola Growers' Assoc. (Alt)
R.R. #1
GOWANSTOWN, Ont
N0G 1Y0
VSC
Tel: 519-343-3035
Fax: 519-343-4589
E-mail: bradm@wcl.on.ca

Mr. Dave McClary
Ontario Soybean Growers Marketing Board
R.R. #1
ARVA, Ontario
N0M 1C0
VSC
Tel: 519-660-0261
FAX: 519-660-0976
E-mail:

Mr. Don McClure [NKSL]
Novartis Seed [CSTA-PB-ALT]
R.R. #1
ARVA, Ontario
N0M 1C0
VSC
CSS
Tel: 519-461-0072 x 232
Fax: 519-461-0770
E-mail:

Mr. Euclid Mailloux
Ont. Soybean Growers'Marketing Board (Alt)
R.R. #1
STONEY POINT, Ontario
N0R 1N0
VSC
Tel: 519-798-5835
Fax: 519-798-3730
E-mail:

Dr. Stephan Molnar
Agriculture & Agri-Food Canada
Eastern Cereal and Oilseed Res. Crt.
Room 4014, K.W. Neatby Bldg.
C.E.F.
OTTAWA, Ont.
K1A 0C6
ROC
Tel: 613-759-1687
Fax: 613-759-1701
E-mail: molnarsj@em.agr.ca

Dr. Vaino Poysa
Secretary, Variety Committee
Agriculture & Agri-Food Canada
Harrow Research Centre
HARROW, Ontario
VSC
CSS
Tel: 519-738-2251 x 467
Fax: 519-738-2929
E-mail:

Dr. Istvan Rajcan [2800 Co-ordinator]
Dept. of Plant Agriculture
University of Guelph
GUELPH, Ontario
N1G 2W1
VSC
CSS
Tel: 519-824-4120 x 3564
Fax: 519-763-8933
E-mail: irajcan@plant.uoguelph.ca

Ms. Joan McKinlay
OMAFRA, Crop Technology
Programme (Alt)
181 Toronto St., S.
MARKDALE, Ontario
N0C 1H0
ROC
CSC
Tel: 519-986-2040
Fax: 519-986-3014
E-mail: jmckinla@omafra.gov.on.ca

Mr. John Rowsell
N.L. Agr. Res. Stn.
NEW LISKEARD, Ontario
P0J 1P0
ROC
Tel: 705-647-6701
Fax: 705-647-7008
E-mail:

Mr. John Rowsell
N.L. Agr. Res. Stn.
NEW LISKEARD, Ontario
P0J 1P0
ROC
Tel: 705-647-6701
Fax: 705-647-7008
E-mail:

Mr. John Van Herk, Jr [HYLD]
Hyland/W.G. Thompson & Sons Ltd.
P.O. Box 130
BLENHEIM, Ontario
N0P 1A0
VSC CSS CSC
Tel: 519-676-8146
Fax: 519-676-5674
E-mail: jvanherk@wgthompson.com

Mr. Kent Schubert [ZENS] [CSTA]
23 Wilsonview Avenue
GUELPH, Ont.
N1G 2W5
VSC CSS CSC
Tel: 519-763-4592
Fax: 519-763-4753
E-mail:

Dr. Harvey Voldeng [PRC;SECP}
Plant Research Centre
Agriculture & Agri- Food Canada
C.E.F., Neatby Building
OTTAWA, Ontario
K1A 0C6
ROC
CSS
Tel: 613-995-3700
Fax: 613-759-1701

Mr. Rob Templeman, Chair
OOPSCC
OMAFRA
581 Huron St
STRATFORD, Ont.
N5A 5T8
VSC
Tel: 519-271-0280
Fax: 519-273-5278
E-mail: rtemplem@omafra.gov.on.ca

Mr. Tom Welacky
Agriculture & Agri-Food Canada
Greenhouse & Processing Crops
Research
Centre
HARROW, Ontario
N0R 1G0
VSC
Tel: 519-738-2251 x 469
Fax: 519-738-2929
E-mail: welackyt@em.agr.ca

Mr. Albert Tenuta
OMAFRA, Crop Technology Programme
Ridgetown College Agric. Tech.
RIDGETOWN, Ontario
N0P 2C0
VSC
Tel: 519-674-1617
Fax: 519-674-1564
E-mail: atenuta@omafra.gov.on.ca

Dr. Pierre Turcotte [EX OF]
Coordinator of Quebec Soybean Trials
MAPAQ, 335 Chemin des 25 est
SAINT-BRUNO-DE-MONTARVILLE,P.Q.
J3V 4P6
VSC
CANO
Tel: 450-653-4413
Fax: 450-441-5694
E-mail:

Mr. Tim Welbanks [CSTA-PB]
Pioneer Hi-Bred Ltd.
P.O. Box 730
CHATHAM, Ontario
N7M 5L1
VSC
Tel: 519-352-6350
Fax: 519-436-6753
E-mail:

Mr. Bill Zubrinic
Ontario Oil Crushers Assoc.
Canamera Div. / Central Soya of Canada Ltd.
515 Victoria Ave., N.
HAMILTON, Ontario
L8N 3K7
VSC
Tel: 905-527-9121
Fax: 905-527-3162

Members of the Ontario Pulse Committee - Main Committee

Robert C. Roy, Chair (1998-2000)
Agriculture and Agri-Food Canada
Southern Crop Protection and
Food Research Centre (Delhi)
P.O. Box 186, Delhi, Ont., N4B 2W9
Phone: (519) 528-1950
Fax: (519) 582-4223
e-mail: royr@em.agr.ca

Rob Templeman
Ontario Ministry of Agriculture, Food and Rural Affairs
413 Hibernia St.
Stratford, Ontario, N5A 5W2
Phone: (519) 271-0280
Fax: (519) 273-3278

Chris Gillard, Secretary (1997- 1999)
Ridgetown College, University of Guelph
Main St. E., Ridgetown, ON
N0P 2C0
Phone: (519) 674-1632
Fax: (519) 674-1600
e-mail:
cgillard@ridgetownc.uofguelph.ca

Martin Huzevka, General Manager
Ontario White Bean Producers
140 Raney Cres
London, Ontario, N6L 1C3
Phone: (519) 652-3566
Fax: (519) 652-9607

Robert C. Roy, Treasurer (1998-2000)
Agriculture and Agri-Food Canada
Southern Crop Protection and
Food Research Centre (Delhi)
P.O. Box 186, Delhi, Ontario, N4B 2W9
Phone: (519) 582-1950
Fax: (519) 582-4223
e-mail: royr@em.agr.ca

Fe Aling
Variety Registration Office (obs)
Plant Industry Directorate
Canadian Food Inspection Agency
59 Camelot Drive
Nepean, Ontario, K1A 0Y9
Phone: (613) 225-2342
Fax: (613) 228-6629
e-mail: faling@em.nrc4.ottfpi6.ca

Soon J. Park
Agriculture and Agri-Food
CanadaHarrow Research Centre
Harrow, Ontario, N0R 1G0
Phone: (519) 738-2251
Fax: (519) 738-2929
e-mail: parks@em.agr.ca

Art Bolton
Canadian Seed Growers' Association
R.R. # 1
Dublin, Ontario, N0K 1E0
Phone: (519) 527-0455
Fax: (519) 527-0787

Calvin Schmidt
Ontario Coloured Bean Growers' Association
R.R. #1
Gadshill, Ontario, N0K 1J0
Phone: (519) 656-2761
Fax: (519) 656-3252

Tom Michaels
Plant Agriculture Department
University of Guelph
Guelph, Ontario, N1G 2W1
Phone: (519) 824-4120 (ext 3392)
Fax: (519) 763-8933
e-mail: tmichaels@crop.uoguelph.ca

Mike Tu
Agriculture and Agri-Food Canada
Harrow Research Centre
Harrow, Ontario, N0R 1G0
Phone: (519) 738-2251
Fax: (519) 738-2929
e-mail: tum@em.agr.ca

Jeff Ferguson
Ontario Bean Dealers Association
R.R. #6
St. Thomas, Ontario, N5P 3T1
Phone: (519) 631-3463
Fax: (519) 631-8843

John Van HerkCPB of CSTA
c/o Hyland Seeds
P.O. Box 130
Blenheim, Ontario, N0P 1A0
Phone: (519) 676-8146
Fax: (519) 676-5674
E-mail: Jvanherk@wgthompson.com

Martin Guerts
Sweet Lupin Growers' Association
R.R. #1
Thornloe, Ontario, P0J 1S0
Phone: (705) 563-2131

John Madill
Crop Science Department
Kemptville College, University of Guelph
Kemptville, Ontario K0G 1J0
Phone: (613) 258-8444
Fax: (613) 258-8384

Diana Yanik (Obs.)
Quality Lab
H. J. Heinz Co., Ltd.
Erie Street, South
Leamington, Ontario
N8H 3W8
Phone: (519) 322-4024
Fax: (519) 322-4104

Les Coleman
Ontario Seed Grower's Association
R.R. # 3
Kippen, Ontario, N0M 2E0
Phone: (519) 263-2990
Fax: (519) 263-2420

Ontario Pulse Crop Committee -
Research Planning and Assessment Subcommittee

Robert C. Roy, Chair (1998-2000)
Agriculture and Agri-Food Canada
Southern Crop Protection and
Food Research Centre (Delhi)
P.O. Box 186, Delhi, Ont., N4B 2W9
Phone: (519) 528-1950
Fax: (519) 582-4223
e-mail: royr@em.agr.ca

Chris Gillard, Secretary (1997- 1999)
Ridgetown College, University of
Guelph
Main St. E., Ridgetown, ON N0P
2C0
Phone: (519) 674-1632
Fax: (519) 674-1600
e-mail:
cgillard@ridgetownc.uofguelph.ca

Robert C. Roy, Treasurer (1998-
2000)
Agriculture and Agri-Food Canada
Southern Crop Protection and
Food Research Centre (Delhi)
P.O. Box 186, Delhi, Ontario, N4B
2W9
Phone: (519) 582-1950
Fax: (519) 582-4223
e-mail: royr@em.agr.ca

Soon J. Park
Agriculture and Agri-Food Canada
Harrow Research Centre
Harrow, Ontario, N0R 1G0
Phone: (519) 738-2251
Fax: (519) 738-2929
e-mail: parks@em.agr.ca

John Thomson
Ontario White Bean Producers
R.R. # 2
Kippen, Ontario, N0M 2E0
Phone: (519) 263-3034

Art Bolton
Canadian Seed Growers' Association
R. R. # 1
Dublin, ON, N0K 1E0
Phone: (519) 527-0455
Fax: (519) 527-0787

Martin Guerts
Sweet Lupin Growers' Association
R.R. # 1
Thornloe, Ontario, P0J 1S0
Phone: (705) 563-2131
Fax: (705)

Calvin Schmidt
Ontario Coloured Bean Growers'
Association
R.R. #1
Gadshill, Ontario, N0K 1J0
Phone: (519) 656-2761
Fax: (519) 656-3252

Rob Templeman
Ontario Ministry of Agriculture, Food and Rural Affairs
413 Hibernia St
Stratford, Ontario, N5A 5W2
Phone: (519) 271-0280
Fax: (519) 273-3278

Mike Tu
Agriculture and Agri-Food Canada
Harrow Research Centre
Harrow, Ontario, N0R 1G0
Phone: (519) 738-2251
Fax: (519) 738-2929
e-mail: tum@em.agr.ca

Art Schaafsma
Ridgetown College, University of Guelph
Ridgetown, Ontario, N0P 2C0
Phone: (519) 674-5456
Fax: (519) 674-3504

Robert Fotheringham
Ontario White Bean Producers
R.R. # 4
Seaforth, Ontario, N0K 1W0
Phone: (519) 233-9196
Fax: (519) 233-9196

Jeff Ferguson
Ontario Bean Dealers Association
R.R. #6
St. Thomas, Ontario, N5P 3T1
Phone: (519) 631-3463
Fax: (519) 631-8843

Tom Michaels
Plant Agriculture Department
University of Guelph
Guelph, Ontario, N1G 2W1
Phone: (519) 824-4120 (ext 3392)
Fax: (519) 763-8933
e-mail: tmichaels@crop.uoguelph.ca

Martin Huzevka, General Manager
Ontario White Bean Producers
140 Raney Cres
London, Ontario, N6L 1C3
Phone: (519) 652-3566
Fax: (519) 652-9607
e-mail: whitepeabeans@wwdc.com

John Madill
Crop Science Department
Kemptville College, University of Guelph
Kemptville, Ontario K0G 1J0
Phone: (613) 258-8444
Fax: (613) 258-8384

Diana Yanik (Obs.)
Quality Lab
H. J. Heinz Co., Ltd.
Erie Street, South
Leamington, Ont. N8H 3W8
Phone: (519) 322-4024
Fax: (519) 322-4104

Jeff Allan (alternate - OSGA)
Brucefield, Ontario,
Phone: (519) 233-9846
e-mail: allan@toc.on.ca

Les Coleman
Ontario Seed Grower's Association
R.R. # 3
Kippen, Ontario, N0M 2E0
Phone: (519) 263-2990

Bob Hall
Department of Environmental Biology
University of Guelph
Guelph, Ontario, N1G 2W1
Phone: (519) 824-4120
Fax: (519) 837-0442
e-mail: rhall@evhort.uoguelph.ca

Ontario Pulse Crop Committee -
Variety Subcommittee

Chris Gillard, Chair (1997 to 1999)
Ridgetown College, University of Guelph
Main St. E., Ridgetown ON N0P 2C0
Phone: (519) 674-1632
Fax: (519) 674-1600
e-mail: cgillard@ridgetownc.uoguelph.ca

Soon J. Park, Secretary (1995-1998)
Agriculture and Agri-Food Canada
Harrow Research Centre
Harrow, Ontario, N0R 1G0
Phone: (519) 738-2251
Fax: (519) 738-2929
e-mail: parks@em.agr.ca

Robert C. Roy, Treasurer (1998-2000)
Agriculture and Agri-Food Canada
Pest Management Research Centre
P.O. Box 186
Delhi, Ontario, N4B 2W9
Phone: (519) 582-1950
Fax: (519) 582-4223
e-mail: royr@em.agr.ca

Rob Templeman
Ontario Ministry of Agriculture, Food and Rural Affairs
413 Hibernia St
Stratford, Ontario, N5A 5W2
Phone: (519) 271-0280
Fax: (519) 273-3278

Fe Aling
Variety Registration Office (obs)
Plant Industry Directorate
Canadian Food Inspection Agency
59 Camelot Drive
Nepean, Ontario, K1A 0Y9
Phone: (613) 225-2342
Fax: (613) 228-6629
e-mail: faling@em.ncr4.ottfpi6.ca

Art Bolton
Canadian Seed Growers' Association
R. R. #1
Dublin, ON N0K 1E0
Phone: (519) 527-0455
Fax: (519) 527-0787

Martin Guerts
Sweet Lupin Growers' Association
R.R. #1, Thornloe, Ontario, P0J 1S0
Phone: (705) 563-2131

Bernie Wolfe
Ontario Coloured Bean Growers Association
R.R. # 5
Mitchell, ON,
Phone: (519) 348-4141
Fax: (519) 348-8165
e-mail: Wbwolfe@orc.ca

Martin Huzevka, General Manager
Ontario White Bean Producers
140 Raney Cres
London, Ontario, N6L 1C3
Phone: (519) 652-3566
Fax: (519) 652-9607
e-mail: whitepeabeans@wwdc.com

Mike Tu
Agriculture and Agri-Food
CanadaHarrow Research Centre
Harrow, Ontario, N0R 1G0
Phone: (519) 738-2251
Fax: (519) 738-2929

Jeff Ferguson
Ontario Bean Dealers Association
R.R. #6
St. Thomas, Ontario,
Phone: (519) 631-3463
Fax: (519) 631-8843

Les Coleman
Ontario Seed Grower's Association
R.R. # 3
Kippen, Ontario, N0M 2E0
Phone: (519) 263-2990
Fax: (519) 263-2420

John Van Herk
CPB of CSTA
c/o Hyland Seeds
P.O. Box 130
Blenheim, Ontario
Phone: (519) 676-8146
Fax: (519) 676-5674 E-mail:
Jvanherk@wgthompson.com

Calvin Schmidt
Ontario Coloured Bean Growers'
Association
R.R. #1, Gadshill, Ontario, N0K 1J0
Phone: (519) 656-2761
Fax: (519) 656-3252

Diana Yanik (Obs.)
Quality Lab
H. J. Heinz Co., Ltd.
Erie Street, South
Leamington, Ontario
N8H 3W8
Phone: (519) 322-4024
Fax: (519) 322-4104

Tom Michaels
Crop Science Department
University of Guelph
Guelph, Ontario, N1G 2W1
Phone: (519) 824-4120 (ext 3392)
Fax: (519) 763-8933
e-mail: tmichaels@crop.uoguelph.ca

D.L. VanHooren
Ontario Ministry of Agriculture, Food
and Rural Affairs
P.O. Box 186
Delhi, Ontario, N4B 2W9
Phone: (519) 582-1956
Fax: (519) 582-4504

H.M.Haji
Canadian Tobacco Research
Foundation
Southern Crop Protection and Food
Research Centre
P.O.Box 186
Delhi, ON
Phone: (519) 582-1950
Fax: (519) 582-4223

John Madill
Crop Science Department
Kemptville College, University of
Guelph
Kemptville, Ontario K0G 1J0
Phone: (613) 258-8444
Fax: (613) 258-8384

MEMBERS OF ONTARIO TOBACCO COMMITTEE AND ITS SUBCOMMITTEES

Ontario Tobacco Research and Services Committee

Ontario Tobacco Production Practices Subcommittee

D.L. VanHooren
Ontario Ministry of Agriculture, Food and Rural Affairs
P.O. Box 186
Delhi, Ontario, N4B 2W9
Phone: (519) 582-1956
Fax: (519) 582-4504

2-As Designated Ontario Flue-Cured Tobacco Growers' Marketing Board
P.O. Box 70
Tillsonburg, Ontario, N4G 4H4
Phone: (519) 842-3661
Fax: (519) 842-7813

A. Veinot
Ontario Ministry of Agriculture, Food and Rural Affairs
P.O. Box 186
Delhi, Ontario, N4B 2W9
Phone: (519) 582-1956
Fax: (519) 582-4504

1-As Designated Imperial Tobacco Ltd.
3810, rue St-Antoine St.
Montreal, Quebec, H4C 1B5
Phone: (514) 932-6161
Fax: (514) 934-5928

H.M.Haji
Canadian Tobacco Research Foundation
Southern Crop Protection and Food Research Centre
P.O.Box 186
Delhi, ON
Phone: (519) 582-1950
Fax: (519) 582-4223

1-As Designated
RJR-Macdonald Inc.
2455 Ontario Street East
Montreal, Quebec, H2K 1W3
Phone: (514) 598-2525
Fax: (514) 598-0897

1-As Designated Rothmans, Benson & Hedges
64 Samor Road
North York, Ontario, M6A 1J7
Phone: (416) 789-7711
Fax: (416) 789-2386

Ontario Tobacco Variety Subcommittee

H.M. Haji, Chair
Canadian Tobacco Research Foundation
Southern Crop Protection and Food Research Centre
P.O. Box 186
Delhi, Ontario, N4B 2W9
Phone: (519) 582-1950
Fax: (519) 582-4223

2-As Designated Imperial Tobacco Ltd.
3810, rue St-Antoine St.
Montreal, Quebec, H4C 1B5
Phone: (514) 932-6161
Fax: (514) 934-5928

D.L. VanHooren
Ontario Ministry of Agriculture, Food and Rural Affairs
P.O. Box 186
Delhi, Ontario, N4B 2W9
Phone: (519) 582-1956
Fax: (519) 582-4504

1-As Designated
RJR-Macdonald Inc.
2455 Ontario Street East
Montreal, Quebec, H2K 1W3
Phone: (514) 598-2525
Fax: (514) 598-0897

3-As Designated Ontario Flue-Cured Tobacco Growers' Marketing Board
P.O. Box 70
Tillsonburg, Ontario, N4G 4H4
Phone: (519) 842-3661
Fax: (519) 842-7813

1-As Designated Rothmans, Benson & Hedges
64 Samor Road
North York, Ontario, M6A 1J7
Phone: (416) 789-7711
Fax: (416) 789-2386

1-As Designated
Canadian Tobacco Seed Producers

2-As Designated
Tobacco Exporters Association
c/o Simcoe Leaf Tobacco
P.O. Box 280
Simcoe, Ontario, N3Y 4L1
Phone: (519) 426-22-1
Fax: (519) 426-0474